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Classification and Interpretation of some Ecosystems of the Rocky Mountain Trench, Prince George Forest Region, British Columbia

First Approximation

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1.0 INTRODUCTION

Since the early 1970's, the British Columbia Ministry of Forests has been developing and implementing a system of ecological classification. The ecosystem classification in the Prince George Forest Region was initiated in 1979 and this manual is the first in a series presenting the classification of the Region. The classification system follows, with some modification, the Biogeoclimatic System developed primarily by Dr. V.J. Krajina and his students at the University of British Columbia (see Krajina 1965, 1972). The ecological units developed in this classification are a synthesis of vegetation, soil, and climatic data.

The aim of this ecological classification system is to provide a rational framework for both forest and range management. The ecosystem classification can be used for day-to-day operations, planning, and as a framework for operational or basic research. Consequently, the user-group for this manual includes field technicians, land managers, planners, and research personnel. This report is an operational manual intended for office use. Material will be extracted from this publication and modified into a "field guide".

This manual includes a brief description of the Ecosystem Classification System; a general introduction to the vegetation, soils, and climate of the study area; a characterization of the biogeoclimatic zones and subzones of the area; detailed descriptions of the ecosystem units; and selected management interpretations for these units. The ecosystem units described are based on data collected[1] and synthesized by the Ecology Section, Ministry of Forests, Prince George Region, except for data and units of the Wet Interior Cedar - Hemlock biogeoclimatic subzone (ICHb), which were determined by the Ecology Section, Nelson Forest Region. These units may be subject to revision when more data are collected.

---

[1] Methods of data collection are fully discussed in Walmsley *et al.* (1980).

The selected management interpretations have been made with the aid of Regional and District Ministry of Forests personnel. They are only presented as a guide to forest managers, not as absolute policy, and as with any first approximation, will be subject to change as more operational data are gathered.

2.0 ECOSYSTEM CLASSIFICATION SYSTEM

The purpose of this section is to briefly outline the biogeoclimatic system of ecosystem classification and to discuss some of the important concepts and terms integral to understanding this system. This taxonomic classification of ecosystems was originally developed by Dr. V.J. Krajina and his students at the University of British Columbia. Significant modifications and additions have occurred in the system over the years, but Dr. Krajina provided the fundamental concepts behind this system. Individuals interested in more information than that provided in this section should consult Beil et al. (1976), Courtin et al.(1984), Klinka et al. (1979), Kojima (1981), Krajina (1965, 1969, 1972), Pojar (1983), and Pojar et al. (1984). A detailed explanation of the system is being prepared by Klinka et al (1984)[1]. Much of the information presented here has been extracted from Courtin et al. (1984) and Pojar (1983).

2.1 Concepts

The biogeoclimatic classification system[2] is a taxonomic classification of ecosystems or biogeocoenoses. The system involves five integration levels (or sections): ecosystem (or biogeocoenotic), climatic (biogeoclimatic or zonal), vegetation (or phytocoenotic), site, and interpretive. Although these sections originate in different ecological schools, Krajina (1969, 1972, 1977) organized them into a single system and, in doing so, provided an efficient and effective system for the organization and application of knowledge about ecosystems. The integration levels are not independent classifications. Together they can be used to explain relationships and correlate ecosystems. Each of these levels will be explained briefly later in the text.

---

[1] Klinka, K., J. Pojar and D. Meidinger. Taxonomic classification of ecosystems in British Columbia. B.C. Ministry of Forests, Victoria, B.C. In preparation.

[2] Also called ecosystematic or synecological classification (Krajina 1969, 1972, 1977).

2.1.1 Ecosystem

Living organisms (or biota) and their non-living (or abiotic) environment are inseparably interrelated and interact with each other. Any unit of area that includes the entire "community" of organisms interacting with the physical environment so that a flow of energy leads to a clear relationship between producers and consumers (i.e. trophic structure), a level of biotic diversity, and certain material cycles (e.g. nutrient cycling), is called an ecological system or ecosystem (Odum 1971:8).

Although the term ecosystem, as proposed by Tansley (1935), is a well-accepted conceptual and functional unit in ecology, it is too broadly defined and lacks a definitive level to be of use in a formal ecosystem classification. Krajina (1960) therefore proposed the use of Sukachev's biogeocoenose to represent a basic ecosystem (see Sukachev and Dylis 1964). We use the two terms interchangeably, although the biogeocoenose actually has a more specific definition. The biogeocoenose (or ecosystem) is a landscape unit relatively uniform in the composition, structure, and properties of both the biotic (e.g., vegetation and microorganisms) and abiotic (e.g., climate and soil) environments and their interactions.

2.1.1.1 Zonal Ecosystem

Climate is an extremely important determinant of the nature of terrestrial ecosystems. A classification of ecosystems becomes even more useful and meaningful if it groups ecosystems influenced by the same regional climate. This is usually difficult, as climatic data are often sparse or lacking and climatic data analysis alone will not produce a reliable functional link between climate and ecosystems. The concept of the zonal ecosystem provides this link.

The zonal ecosystem is that ecosystem which best reflects the regional climate. The integrated influence of the regional climate on the vegetation, soil, and other ecosystem components is the most strongly expressed in zonal ecosystems, relative to other non-zonal ecosystems in the area. The zonal ecosystems are the least influenced by the local relief and by the physical and chemical properties of soil parent materials. They generally occur on gentle to moderate (5-30%) slopes, in mid to upper slope positions or, in other words, slope positions that neither shed nor receive excessive amounts of water or nutrients. These ecosystems have medium or mesic moisture regimes[1] and medium or mesotrophic nutrient regimes. The soils are usually[2] medium (or loamy) in texture, moderately pervious, freely drained (i.e. well to moderately well), greater than one metre deep, and with no root restricting layer (i.e. strongly compacted till, ortstein, etc.) within one metre of the soil surface.

The vegetation and other living components (e.g. microorganisms, soil arthropods, etc.) of a zonal ecosystem should be at a climax stage of development in order for the ecosystem to be used to infer the regional climate.[3, 4]

Other ecosystems on the landscape are influenced more strongly by the local physiography (e.g. slope position or gradient, and/or aspect), and/or chemical and physical properties of the parent materials. They are, therefore, drier, wetter, richer or poorer than the zonal ecosystem. Hence, they do not reflect the regional climate as clearly as zonal ecosystems.

---

[1] Mesic and mesotrophic are relative terms that actually represent different quantitative values in areas of different regional climate.

[2] These criteria apply throughout most of B.C., but not to very wet, northern coastal areas where organic soils predominate not only in depressions, but also on gently to moderately sloping mid to upper slope positions.

[3] See next section for a discussion of "climax".

[4] Exceptions may occur where fire or biotic climaxes prevail.

Since the vegetation and soils of zonal ecosystems best represent the regional climate, they are used to both characterize biogeoclimatic units and to delineate their geographical extent. The zonal ecosystem links the climatic and ecosystem levels of the classification (see discussion of ecosystem association and biogeoclimatic subzone).

2.1.2 Climax and Succession

2.1.2.1 Climax

In ecological terms, climax refers to the final stage of a developmental series (or succession). The climax stage is a dynamic equilibrium or steady state, not a static endpoint. A climax ecosystem is stable or self-perpetuating, i.e., all the plant species are capable of regeneration. Mortality is in balance with regeneration for all species populations. In climax forest ecosystems, those tree species capable of regenerating under the forest canopy will be present in all age classes, from seedling to mature tree. All the living components of a climax ecosystem are in equilibrium with both the physical environment and each other.

2.1.2.2 Types of Climax

Climatic climax ecosystems (or zonal ecosystems) occur on zonal sites. They reflect the development potential of the regional climate.

Other types of climax ecosystems occur where specific environmental factors influence ecosystem development more than the regional climate. Edaphic climax ecosystems occur on sites where extreme soil or substrate conditions, such as coarse texture, high base saturation, poor drainage, or root-restricting layer, influence ecosystem development. A topographic climax reflects the compensating effects of topography on local climate (e.g. a steep south-facing slope). Topoedaphic climaxes reflect the combined influence of extreme soil or substrate conditions and topography. Fire climaxes may occur in some areas due to recurring wildfires.

2.1.2.3 Succession

Ecosystems reach climax through a process of change called ecological succession. Succession is an orderly process of ecosystem development that involves changes in species composition and structure, and ecosystem processes, through time (cf. Odum 1969). Succession is reasonably directional, and therefore, predictable. The sequential series of successional stages are called seres. The endpoint of succession is the mature, self-perpetuating, climax ecosystem.

2.1.2.4 Potential Climax and Classification

This classification system is based on sampling climax or near-climax ecosystems. At present, these ecosystems are common throughout most of British Columbia. In the future though, industrial forestry will maintain most of the productive ecosystems in a successional stage -- usually less than 100 years old. Will this climax-based classification system become obsolete? It will not, if logging-related disturbance is not excessive. The potential and present limitations of a logged site remain similar to what was determined by the classification and interpretation of the climax ecosystem. Succession will proceed towards climax, and this trend can usually be identified even in very young stands. It is possible to recognize the potential climax ecosystem in the early seral stages, and therefore, to make interpretations and predictions about the seral ecosystems from pioneer to climax stages of succession.

With further study, it will be possible to describe the successional stages and pathways (depending on stand history and management regime) of each ecosystem unit, and thereby produce an integrated classification of seral ecosystem units.

2.2 Outline of the System

As mentioned previously, the system involves five integration levels or sections: ecosystem, climatic, vegetation, site and interpretive. Krajina (1969, 1972, 1977) organized these into a single system for the organization and application of knowledge about ecosystems. The system has since evolved with both additions and modifications.

2.2.1 Ecosystem (or Biogeocoenotic) Units

The ecosystem level is the most detailed level of the classification system. The taxonomic units at this level are the association, subassociation and type. Phases are also recognized, but they are not formal categories in the classification system. The ecosystem (or biogeocoenotic) units recognized in this study are the ecosystem association and subassociation. Phases have been recognized for some associations.

Where association or subassociation appear in this manual without a modifer, i.e. plant, ecosystem, or site, they refer to an ecosystem association or subassociation, respectively.

2.2.1.1 Ecosystem Association

Associations are groups of floristically related ecosystems (i.e. they have vegetation belonging to the same plant association [sensu Braun-Blanquet 1932]) within a uniform regional climate (i.e., biogeoclimatic subzone). Ecosystem associations are identified from the synthesis of data from sampling climax ecosystems[1]. Edaphic limits are imposed on the association by the collective ecological amplitude of the characteristic combination of species[2]. Soils can vary within an association because the various soil and site factors may interact in different ways to produce the same (climax) vegetation.

Although plant associations, and therefore the characteristic combination of species for the ecosystem associations, are defined using primarily vegetation criteria, both these units are very practical. Vegetation is readily observed and described, and plants integrate and reflect ecosystematic factors (such as climate, moisture and nutrient levels, and time). Vegetation is a product, as well as a part, of the environment.

For these reasons, and for brevity and familiarity, the ecosystem association is labeled with the name of the climax plant association. For example, in the Sub-Boreal Spruce Zone near Valemount, B.C., there is an association labeled, Picea (glauca x engelmannii) - Equisetum. For completeness, the name for this ecosystem unit should incorporate physiographic and soil features, but this would be too cumbersome. However, a reference to the Picea (glauca x engelmannii) - Equisetum association, or Spruce - horsetail association, or SBSh/07, denotes the characteristics of that group of ecosystems: they occur on level, imperfectly to poorly drained fluvial sites; they have developed gleyed soils and moder or mull humus forms; they often have a fluctuating water table; they are nutrient rich and fertile; and, at climax, they develop vegetation that may be characterized by the Picea (glauca x engelmannii) - Equisetum plant association.

---

[1] Although the ecosystem association is initally identified by the synthesis of data from one biogeoclimatic subzone, once the entire geographical range of a plant association has been sampled and the data synthesized, the characteristic combination of species for the plant association will apply to the ecosystem association.

[2] A characteristic combination of species is a group of plant species common to a particular group of samples, but "absent" in other groups to which it is compared. Since it involves a group of plant species, some species may be common to some of the other groups.

2.2.1.2 Ecosystem Subassociation

Associations can be subdivided into subassociations using minor floristic differences. These floristic differences may also correspond to certain edaphic differences, but subassociations are not as easily recognized in the field as are associations.

For example, in the Sub-Boreal Spruce Zone near Valemount, B.C., the zonal association, SBSh/01, has been divided into two subassociations: the SBSh/01.1 or _Rubus_ (_parviflorus_) subassociation, and the SBSh/01.2 or _Vaccinium_ (_myrtilloides_) subassociation. Almost all plant species are common to both subassociations, but they occur with less cover and vigor in the SBSh/01.2. Also, the ecosystems in the SBSh/01.2 subassociation are usually found on drier and nutrient poorer sites than those in the SBSh/01.1.

2.2.1.3 Ecosystem Type

Types have not been classified, to date, in this study area. Types are the lowest taxonomic units in the ecosystem level. They are subdivisions of associations (or subassociations) based on the similarity of certain soil characteristics. The soil factors used[1] to define types include: soil classification to the subgroup level and family particle size (Canada Soil Survey Committee 1978); humus classification to the order level (Klinka _et al_. 1981); parent material (i.e., genetic material in British Columbia Environment and Land Use Committee Secretariat 1978); aspect; and slope gradient. These are used in an ecologically significant combination to define types. Types are named after the association (or subassociation) to which they belong, plus the series of soil attributes. Usually the name is abbreviated using one or two edaphic epithets that differentiate the type within the ecosystem association or subassociation.

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[1] The "level" to which these various soil factors will be used is still under discussion and testing.

2.2.1.4 Ecosystem Phase

The phase is used to subdivide an ecosystem unit into more operationally significant units using primarily physiographic and soil factors, if they are considered important for specific management purposes. Any physiographic or soil feature(s) can be used singly or in combination. Although any of the ecosystem units could be phased, only associations were phased in this study area. Phases are primarily for management purposes and considerable freedom is available for defining phases at various levels of detail. The phase is not a formal category in the classification system.

As previously mentioned, considerable variation in soil properties is possible in some associations due to the compensating effects of the interactions of the various soil parameters. If the differences are considered important for some management interpretations, for instance, silviculture, then an association could be phased on factors such as particle size (coarse vs. fine), slope class, aspect, bedrock geology, soil climate, or parent material. With further sampling, many phases could be allocated to types. For now, however, to meet some forest management objectives phases can provide a more useful classification of ecosystems.

2.2.2 Climatic Level

The climatic (biogeoclimatic or zonal) level provides higher categories in the taxonomic hierarchy for organizing ecosystems on the basis of climatic relationships. The subzone and zone are the biogeoclimatic units recognized in this report. The zones can be allocated to the higher biogeoclimatic units of region and formation. Variants, the lowest unit at this level, and phases, which are not a formal classification unit, were not recognized in this study area. The principal category is subzone; classes of lower and higher ranks are formed by subdividing and grouping subzones, respectively.

2.2.2.1 Biogeoclimatic Subzone

A distinct climatic climax or zonal ecosystem association characterizes a subzone. In other words, a subzone unifies a set of geographically related ecosystems in which the zonal ecosystems are members of the same zonal association. Such a "set" of ecosystems (or a unique sequence of ecosystems) is influenced by one type of regional climate.

Subzones are the basic units of biogeoclimatic classification and are the first to be recognized in the classification process. The climatic and ecosystem levels of the classification are linked through the fundamental relationship between the zonal ecosystem association and the subzone.

Each subzone has a unique set of associations and, therefore, a unique set of corresponding ecological moisture and nutrient regime values. This relationship corresponds to the site level of the classification system. This interrelationship between the climatic, ecosystem, and site levels of the classification is the single most important feature of the system. This imposes functional and geographic limits on the ecosystem association and distinguishes it from the plant association (sensu Braun-Blanquet, which would consist of ecosystems occurring over a wider range of sites, both geographically and functionally). For example, in the Interior Cedar - Hemlock Zone, an oak fern - step moss plant association could occur in more than one subzone, but each subzone would have a different oak fern - step moss ecosystem association that would consist of ecosystems from a more homogeneous climate and on a narrower range of site conditions.

2.2.2.2 Biogeoclimatic Zone

Subzones with affinities in climatic characteristics and zonal ecosystems are grouped into zones. A biogeoclimatic zone, then, consists of one or more subzones with similarity in the structure and composition of the major climatic climax tree, shrub, herb and/or moss species, and overall similarity in the prevailing pedogenic processes. A zone represents a large geographical area with a broadly homogeneous macroclimate.

Zones are usually named by one or more of the dominant climatic climax tree species[1], often with a geographic or physiographic modifier.

2.2.2.3 Biogeoclimatic Regions and Formations

Zones can be grouped into regions, and regions into formations based on more general climatic affinities and characteristics of zonal ecosystems. See Krajina et al. (1982) or Krajina (1969, 1972) for an outline of the regions and formations associated with the zones[2] in this area.

2.2.2.4 Biogeoclimatic Variants

Subzones can be subdivided into variants. A distinct zonal ecosystem subassociation or type would characterize a variant. Variants may or may not be recognized in an area. They reflect areas that are climatically warmer, colder, dryer, wetter or snowier than the "norm" for the subzone. They are still characterized by a different regional climate, but the differences are less distinct than at the subzone level.

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[1] Alpine Tundra Zone is an obvious exception; shrubs are used in the name of the Spruce - Willow - Birch Zone.

[2] The Interior Cedar - Hemlock Zone (ICH) is similar to the Interior Western Hemlock Zone (IWH) of Krajina.

Vegetation differences would be expressed as changes in the proportion and vigor of certain plant species, or differences in stand structure. Soil differences would correspond to changes in the intensity of certain soil-forming processes and may not be markedly expressed in morphological features. Ecosystem pattern on the landscape may differ between variants.

2.2.2.5 Biogeoclimatic phase

The biogeoclimatic phase accounts for variation in the "local" climate of subzones and variants due to local relief. The biogeoclimatic phase is a useful higher category for grouping certain ecosystems that, due to topographic or topoedaphic reasons; are atypical for the regional climate. Examples include extensive areas of grassland occurring only on steep, south slopes within an otherwise forested subzone; enclaves of "coastal" forest on moist, northeastern slopes in an interior continental subzone; and valley-bottom, frost pocket areas in mountainous terrain. Since the phase relates to local climate, it is not a formal category in the classification system.

2.2.3 Vegetation Level

The vegetation (or phytocoenotic) level provides for further generalization of biogeocoenotic units (primarily associations) on the basis of floristic relationships. Vegetation units indicate certain floristic and environmental relationships between ecosystems that cannot be evaluated at either ecosystem or climatic levels. The vegetation level employs a part of the heirarchical floristic system of Braun-Blanquet (1932). Specifically, it employs the categories of plant association, alliance, order, class, and division. This level has not been developed for the ecosystem units identified to date in the Prince George Region. For further information see Braun-Blanquet (1932), Shimwell (1972), Westhoff and Maarel (1978), Mueller-Dombois and Ellenberg (1974), and Courtin _et_ _al_. (1984).

2.2.4 Site Level

As stated previously, when classifying climax ecosystems into ecosystem associations or subassociations, edaphic limits are imposed on the association/subassociation by the collective ecological amplitude of the characteristic combination of species. Those edaphic limits or site factors can be used to identify sites in stages other than climax.

For example, within a specific regional climate, the relationship between the ecosystems and the two general, synthetic ecological (soil) properties (or gradients) - moisture and nutrients, can be shown on an edatopic (or edaphic) grid (see Figure 6.1). This is based on the assumption that, after climate, the supplies of available soil water and nutrients are, in most terrestrial environments, the most important factors affecting the nature and distribution of ecosystems on the landscape.

The moisture gradient is referred to as ecological (soil) moisture regime (or hygrotope) and the nutrient gradient is referred to as ecological (soil) nutrient regime (or trophotope) [explained further in Section 5.1.3]. Both gradients combined are referred to as the edatope. Hygrotope and trophotope integrate a number of site and soil properties. The edatope, then is commonly used as a site variable to identify the "site" association or subassociation.

This discussion implies that all land areas capable of producing vegetation and soils belonging to the same ecosystem association or subassociation at climax are included in one site association or subassociation. Therefore, in this manual, although we are defining and characterizing ecosystem associations and occassionally, subassociations, we are also defining the site characteristics for the site associations/subassociations in the various subzones.

"Zonal" or climatic climax taxa occupy the 4/C, or mesic/mesotrophic, position on the grid. Other units are placed on the grid according to the ecological moisture and nutrient regimes determined by comparison of their floristic and edaphic characteristics with those of zonal taxa. In some climatic environments, depending on the physiographic and geologic diversity, some parts of the grid will remain blank. In some environments, factors other than soil moisture and nutrients may be most important, e.g. snow depth and duration, wind or flooding. In these areas, other "functional" criteria can be used to display ecosystem units. In this report, hygrotopes and trophotopes have been given for all ecosystem (and therefore site) units.

2.2.5 Interpretive Level

The taxonomic classification is used to classify ecosystems irrespective of practical application. By integrating taxonomic units according to their value for a specific purpose, an interpretive classification can be developed. The resulting groups have been called treatment units by Klinka *et al*. (1980*a*, 1980*b*). The treatment units are recurring "classes" of interpretive classification that are designed to present interpretations or predictions about ecosystems for certain forest (or range) management objectives. The treatment units for prescribed burning may differ from the treatment units for tree species selection, or logging method, or any other management practice. Therefore, although broader treatment units are very useful for grouping ecosystems for certain types of interpretations, we have basically treated each ecosystem unit and phase as a separate "treatment unit" (with the exception of the wetter forested bogs and swamps that are usually non-commercial). This is a result of the broad range of silviculture and timber interpretations presented (see Section 8.0).

3.0 ECOLOGICAL CHARACTERISTICS OF THE AREA

3.1 Geographic Area

The study area is primarily located in the Rocky Mountain Trench and in some low elevation side-valleys of the Rocky and Columbia Mountains, between Purden Lake in the northwest and Mica Creek in the southeast (Figure 1.1). The area that has been ecologically classified generally occurs below 1350 m elevation, and lies approximately between lat. 52° and 54°N and long. 118° and 122°W (Figure 1.1, shaded area).

Most of the area is within the McBride Forest District, except a section in the northwest which is part of the Prince George East Forest District.

3.2 Physiography

The physiography of the study area (Figure 1.2) is dominated by the Rocky Mountain Trench. Within the area, the trench extends in a northwesterly direction from Mica Creek to just east of Purden Lake. Other significant physiographic regions include the Rocky Mountains on the east side of the trench, the Columbia Mountains on the west, and the Interior Plateau in the northwest.

The Rocky Mountain Trench is a structurally controlled erosion feature (Holland 1976), ranging in width from 3 to 16 km. From Mica Creek to McBride, the trench is a relatively flat-floored, steep-walled valley, but further northward it becomes wider, with major breaches in the valley walls. At its northwest end, the trench merges into the Interior Plateau at an elevation of approximately 600 m. The southern portion is occupied by McNaughton (Kinbasket) Lake, which was formerly the southward draining Canoe River valley. Northwest from Tete Jaune, the trench is drained by the Fraser River, with the divide between the Fraser and Canoe River drainages occurring at Valemount at

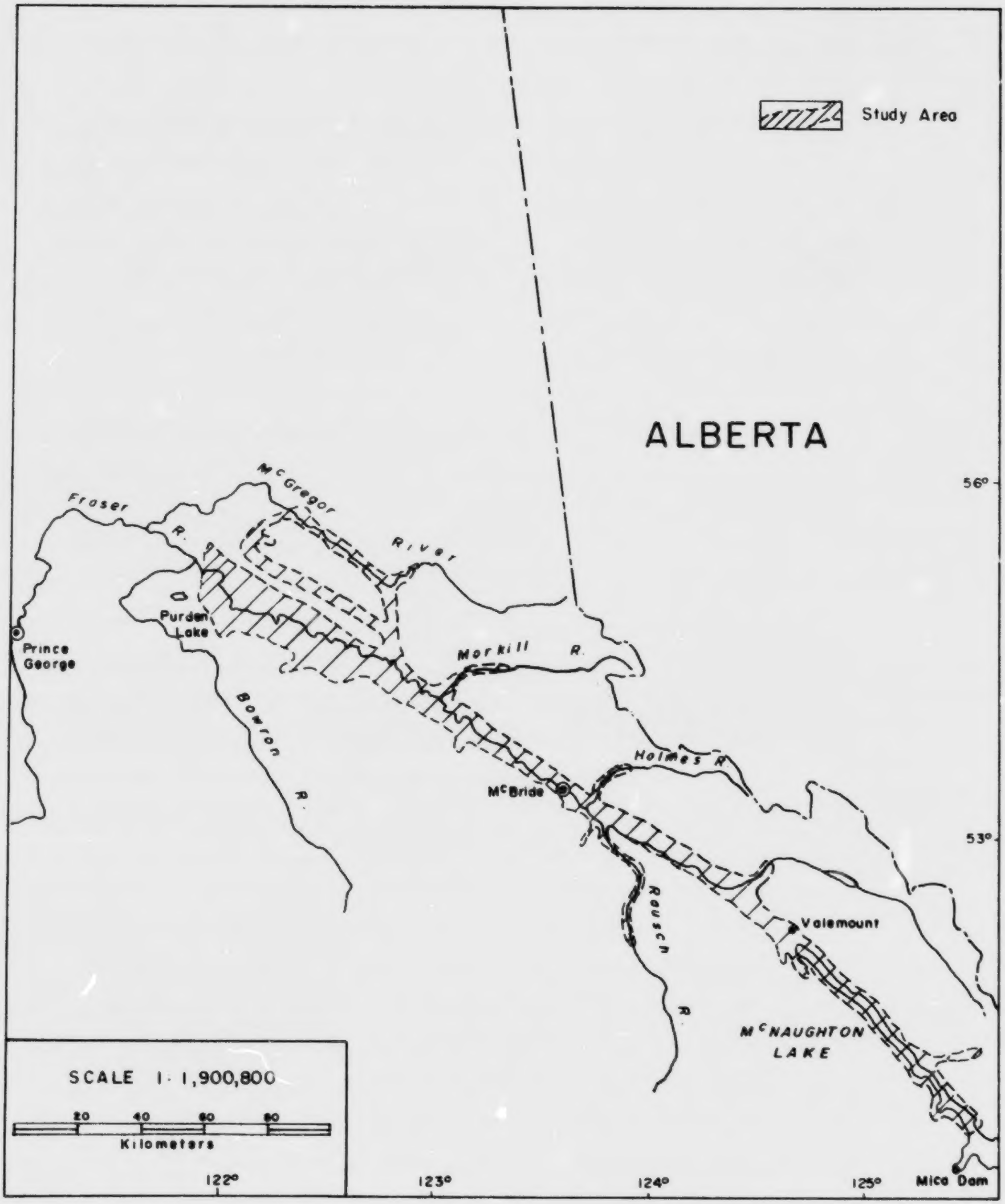
Study Area
ALBERTA
56°
53°
McGregor River
Fraser R.
Purden Lake
Prince George
Morkill R.
Bowron R.
Holmes R.
McBride
Rausch R.
Valemount
McNAUGHTON LAKE
Mica Dam
SCALE 1:1,900,800
20
40
60
80
Kilometers
122°
123°
124°
125°

FIG. 1.1. Geographic location of the study area.

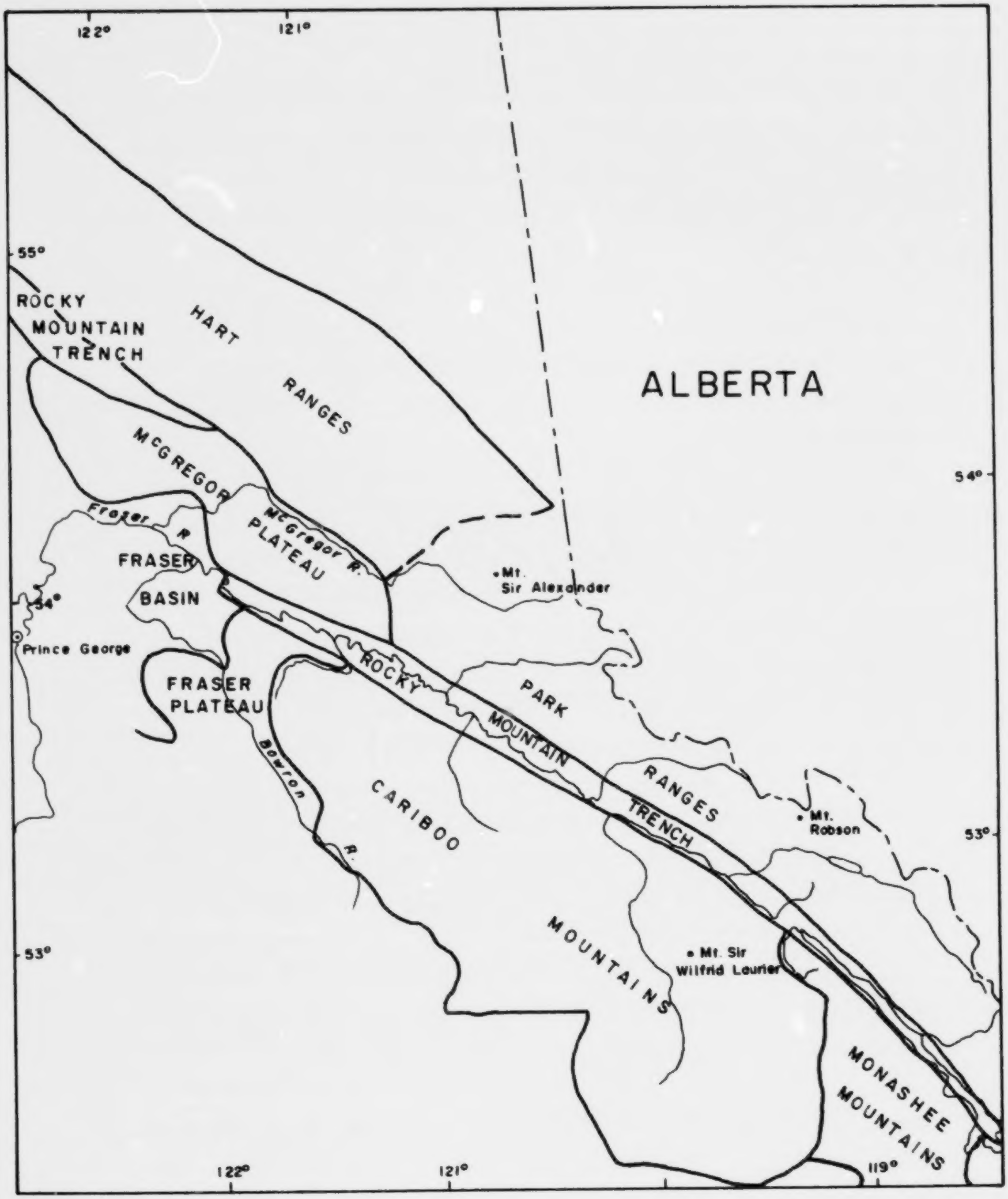
122°
121°
55°
54°
53°
122°
121°
119°
ALBERTA
ROCKY MOUNTAIN TRENCH
HART RANGES
McGREGOR PLATEAU
McGregor R.
Fraser R
FRASER BASIN
Prince George
FRASER PLATEAU
Bowron R.
Mt. Sir Alexander
ROCKY MOUNTAIN TRENCH
PARK RANGES
Mt. Robson
CARIBOO MOUNTAINS
Mt. Sir Wilfrid Laurier
MONASHEE MOUNTAINS

FIG. 1.2. Physiographic subdivisions of the study area.

approximately 800 m in elevation.

The lower elevations of the western Rocky Mountains border the eastern side of the study area. From Wood River to Mount Sir Alexander, the Park Ranges form the boundary, and from Mount Sir Alexander northward, the Hart Ranges bound the area. Elevations of peaks along this entire eastern boundary are in the range of 2150-2650 m. Major tributaries of both the Canoe and Fraser River drainage systems arise in the Rocky Mountains, including Hugh Allen Creek (Canoe), and the Holmes, Morkill and McGregor Rivers (Fraser). The headwaters of the Fraser are also in this section of the Rocky Mountains.

The northern end of the Monashee Mountains and eastern side of the Cariboo Mountains form the western boundary of the study area. These mountains are separated by the Camp Creek - Albreda River valley. Peaks in the Monashees adjacent to the area rise to approximately 2300 to 3200 m in elevation. The Cariboo Mountains bound the area from Camp Creek to Slim Creek, with peaks in the area north to the Rausch River (the Premier Range) ranging from 2450 to 3400m. Peaks from the Rausch River north to Goat River are lower, in the range of 2200 to 2800 m, and from Goat River to Slim Creek the peaks continue to slowly decrease in height. There are no major tributaries of the Canoe River system that flow from the Monashee mountains; the headwaters of the Canoe arise in the Premier Range. Several relatively large tributaries of the Fraser River arise in the Cariboo mountains, including the McLennan, Rausch, and Goat Rivers.

Where the trench merges into the Interior Plateau, it meets the Fraser Plateau on the west, the Fraser Basin at its north end, and the McGregor Plateau on the east (Figure 1.2). From Slim Creek to Kenneth Creek, the Fraser Plateau is an area of undissected upland lying between 1200 and 1800 m. Only a small section of the study area is included in the Fraser Basin, which has a gently rolling surface generally below 800 m in elevation. Between the Fraser and McGregor Rivers, the McGregor Plateau lies above 900 m elevation and rises up to a maximum of 3000 m. It is almost completely dissected by the Torpy River, another important tributary of the Fraser River.

3.3 Geology

3.3.1 Bedrock Geology

Bedrock is the original source of the various soils in the area: it may weather *in situ*; or it may be transported by the mechanical forces of nature (gravity, water, ice, and wind). The bedrock geology of the area, and of that near to it, plays an important role in the genesis of the present-day soil materials. The bedrock of the entire area is dominated by sedimentary and low-grade metamorphic rocks, but will be considered separately for each physiographic region.

North of Windfall Creek, the dominant rocks of the Monashee Mountains are feldspathic gneiss, quartz mica schist and quartzite (Campbell 1968). These generally weather slowly into coarse-grained materials, although schists are less resistant to weathering and often provide medium-textured materials. The Monashees south of Windfall Creek, the Cariboos north to Goat River, and the Rockies north to the McGregor River all have rock formations dominated by metamorphosed feldspathic sandstones (ortho-quartzites), phyllite, argillite, siltstone, and mica schist, with minor amounts of limestone, slate and conglomerate (Campbell *et al*. 1973). The weathering products of these rock types are variable and may consist of materials that are coarse-textured (quartzites), medium-textured (schist, siltstones, and phyllite), or fine-textured (argillite, shale, and limestone).

In the Cariboo Mountains north of Goat River, and including that section of the Fraser Plateau between Slim and Kenneth Creeks, limestone and dolostone (dolomitic limestone) are more abundant than further south in the Cariboos, but all rock types that occur in the southern section also occur here. In the Hart Ranges, the dominant rocks are intermixed limestone, quartzite, and dolomite. There is also, on lower slopes, some schist, quartz pebble conglomerate, and shale. Bedrock of the higher elevation ridges that occur on the McGregor Plateau is similar to that of the Hart Ranges, with the addition of dolomitic and calcareous shales. (Bayrock and Reimchen 1977).

Around Purden Lake and continuing southeast, there are formations dominated by basic volcanic rocks, usually basalt, chert, and argillite (which generally weather into fine-grained, nutrient-rich materials). These are primarily west of the Bowron River, but may act as a source of surficial deposits in northern sections of the study area.

3.3.2 Surficial Materials

Except for occasional rock outcrops, the study area is covered with surficial materials that were deposited either during the last glacial period or by subsequent post-glacial action. The last major glaciation, or Fraser glaciation, occurred between 19 000 and 10 000 years ago (Howes 1977). The major ice sheet moved in a northeasterly direction across the Interior Plateau (Tipper 1971), until it encountered the Rocky Mountains, where it was diverted north towards the Peace River and southeast along the trench. Valley glaciers descending into the trench converged with this ice sheet. Only peaks above approximately 2000 m escaped the glacial ice. As the glaciers advanced, they picked up bedrock and previous glacial deposits, redepositing this material (morainal deposits) during both advance and subsequent retreat. Water movement in contact with the ice also deposited material (glaciofluvial deposits).

As the ice melted, channels were blocked with morainal materials and stagnant ice blocks, resulting in the formation of ice-dammed lakes. Sediments deposited in these pro-glacial lakes (lacustrine sediments) remained when these lakes finally drained.

Some of these morainal, fluvioglacial, and lacustrine materials have been modified and subsequently redeposited by post-glacial processes. Rivers and streams have deposited materials (fluvial deposits), wind has reworked some of these sediments (eolian deposits), material has reached its present location under the influence of gravity (colluvial deposits), and organic material has accumulated in depressions and in moisture-receiving sites. These post-glacial deposits often mantle the previously deposited glacial sediments.

3.3.2.1 Morainal Deposits

These materials, directly deposited by glacial ice, originally covered all the study area except for the steepest slopes. Uncovered morainal deposits, however, are usually found on the valley walls because most of the deposits in the valley bottoms have been covered with post-glacial deposits, usually lacustrine and fluvial sediments. Morainal deposits are found throughout the study area, with depths varying with topography. Morainal veneers (less than 1 m thick) occur on steep slopes or where bedrock is close to the surface; they are often mixed with colluvium. Morainal blankets (greater than 1 m in depth) are closely associated with long, relatively smooth bedrock-controlled slopes.

These deposits generally consist of non-stratified material and contain a heterogeneous mixture of particle sizes, ranging from large boulders to fine clays. Because they were usually deposited under a heavy ice load, they are often compacted at depth.

3.3.2.2 Glaciofluvial Deposits

These materials were deposited by streams either directly in front of, or in contact with, glacier ice. Because they are associated with fast-flowing, meltwater-fed streams, these materials are often unstratified, have a relatively high stone and gravel content, and are coarse-textured. Examples that occur in the Trench area are the outwash plain between Canoe Mountain and Tete Jaune (Hortie et al. 1970) and the high level terraces (kame terraces) along the trench wall where streams came in contact with the valley glacier. Glaciofluvial materials are scattered randomly throughout the study area.

3.3.2.3 Lacustrine Deposits

These can be divided into two distinct types: those that were deposited in direct contact with glacial ice are described as glaciolacustrine, while those deposited in pro-glacial lakes that were formed behind stagnant ice and subsequently drained as the dams melted are referred to as lacustrine sediments (British Columbia Environment and Land Use Committee Secretariat 1978).

Glaciolacustrine sediments are of little significance in the study area. They usually consist of well stratified silts and clays and may contain ice-rafted stones.

Lacustrine sediments are very extensive in the Rocky Mountain Trench. They are found above present day river floodplains and terraces both south of Valemount (most of these are covered by Kinbasket Lake) and north from Tete Jaune through to Purden Lake. They occur up to an approximate elevation of 880 m in the Trench (Hortie et al. 1970) and also occur in the Morkill River, Slim Creek and Driscoll Creek valleys.

Apart from river deltas, where the sediments are usually coarse, and beach deposits, which are mostly well-sorted gravels and sands, these lacustrine deposits are very fine-textured (silts and clays). Consequently, they have a high water-holding capacity and are generally classed as having mesic or wetter moisture regimes. Because the bedrock source of the fine-textured sediments can contain large amounts of rapidly weathering limestone rocks, many of these unaltered sediments are alkaline in nature.

3.3.2.4 Fluvial Deposits

These deposits include channel deposits (relatively coarse gravel), overbank and flood deposits (coarse textures near the main channel and finer material further away), terrace deposits (textures depending on the flow rate of the stream, becoming more coarse-textured with increasing flow rate), and fluvial fans (often gravelly and cobbly). The most extensive fluvial deposits occur along the Fraser River, with smaller areas along most streams and rivers. Both moisture and nutrient regime vary with the nature of the deposit, although, in general, present-day flood plains tend to be nutrient-rich.

3.3.2.5 Eolian Deposits

These are materials transported and deposited by wind action. The only known deposits are in the Valemount-Tete Jaune area where glacial outwash sands have been reworked, giving typical dune formations. These deposits are medium and fine sands that are generally dry and nutrient-poor. Some eolian sands also occur as veneers over morainal material closer to the trench walls.

3.3.2.6 Colluvial Deposits

These are materials that have reached their present position by direct, gravity-induced movement. Because of the steep slopes of the trench, these deposits are very common, although not extensive, throughout the study area. They are usually derived from bedrock and are characteristically rubbly. The texture of the fine material will depend on the nature of the bedrock material, as discussed previously (Section 2.3.1). Because morainal deposits cover most of the valley walls, they are often intermixed with this colluvial material. Colluvium occurs as both blankets and veneers.

3.3.2.7 Organic Deposits

These are materials resulting from vegetative growth, decay, and accumulation, where the rate of accumulation exceeds that of decay. They are common throughout the area, usually as depressions in level lacustrine, or fluvial floodplain, deposits. They also occur less commonly in depressions in morainal material or in bedrock hollows. They are usually small in area, although in the Trench north of Slim Creek they are quite extensive.

3.4 Climate

The climate of the area can be described in general terms as a cold, snowy forest climate (i.e. a climate capable of supporting forests rather than, say, tundra or desert). More specifically, the area may be described as having a continental climate, which is characterized by strong seasonal temperature contrasts and severe winters. However, the regional climate is strongly influenced by the predominant westerly air flow that moderates the continental climate and creates a humid continental climate.

British Columbia lies in a latitudinal belt of predominantly westerly air flow that profoundly affects the climate of B.C. The study area is no exception. The prevailing westerly flow drives air masses formed over the Pacific onto the land surface where they encounter successive mountain barriers. The masses are forced upwards as they approach the mountains, causing cooling and condensation of moisture in the air and resulting in the release of considerable quantities of moisture as both rain and snow (Chilton 1981). Because much of this moisture is released on the western slopes of the mountain ranges, the eastern or leeward slopes are considerably drier. Air masses which have deposited much of their moisture in passing over the Coast Mountains, increase their moisture content (from evaporation and transpiration) over the Interior Plateau. This moisture is then deposited on the western slopes as the masses are forced over the northern Columbia Mountains and Central Rocky Mountains (see Figure 1.3), creating what is commonly termed the "Interior Wet Belt". This precipitation occurs both as rain and snow.

In addition to being effective barriers to the prevailing westerlies, and their resulting influence on moisture distribution, the Rocky Mountains usually block the westward passage of continental Arctic air masses which dominate the winter season east of the Rockies. This means that the climate of the area will be influenced more by the moister, warmer maritime Polar air masses, which produce the relatively high snowfall in the area. During the summer months, maritime Polar air masses dominate. These generally produce a cool to warm, moderately moist summer season. Therefore, this area has a humid continental climate which is wetter and milder than areas with a true continental subarctic climate east of the Rocky Mountains.

Topography is obviously a primary factor influencing the climate of the study area. Some areas are in more of a "rainshadow" then others, while other areas are influenced by "cold air drainage". Elevation also influences climate; in general terms, precipitation increases and temperature decreases with elevation (Schaefer 1978). The strongest "rainshadow" occurs in the area from Valemount to Dunster. This area occurs in the lee of the highest mountains of the Premier range. Areas to the north become progressively wetter as the mountain barrier to the west becomes

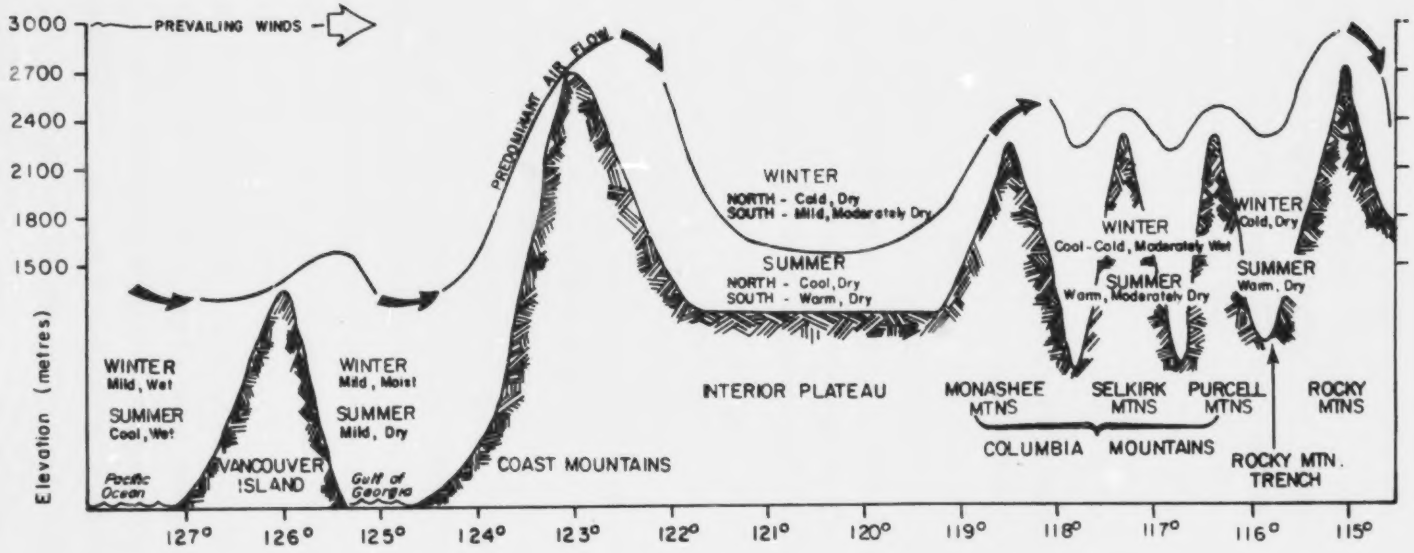
3000
2700
2400
2100
1800
1500
Elevation (metres)
PREVAILING WINDS
PREDOMINANT AIR FLOW
WINTER
Mild, Wet
SUMMER
Cool, Wet
Pacific Ocean
VANCOUVER ISLAND
WINTER
Mild, Moist
SUMMER
Mild, Dry
Gulf of Georgia
COAST MOUNTAINS
WINTER
NORTH - Cold, Dry
SOUTH - Mild, Moderately Dry
SUMMER
NORTH - Cool, Dry
SOUTH - Warm, Dry
INTERIOR PLATEAU
WINTER
Cool-Cold, Moderately Wet
SUMMER
Warm, Moderately Dry
WINTER
Cold, Dry
SUMMER
Warm, Dry
MONASHEE MTNS
SELKIRK MTNS
PURCELL MTNS
COLUMBIA MOUNTAINS
ROCKY MTNS
ROCKY MTN. TRENCH
127°
126°
125°
124°
123°
122°
121°
120°
119°
118°
117°
116°
115°

FIG. 1.3 Latitudinal cross section of Southern British Columbia illustrating the physiographic diversity and associated climatic regimes (adapted from Chilton 1981).

narrower in width and lower in elevation. In the northern part of the study area, the Rocky Mountains form the major barrier to the "westerlies", resulting in large amounts of precipitation falling within that part of study area. Again, in the southern part of the study area near Mica Creek, there is high precipitation where the mountain barrier to the west narrows in width and is lower in elevation, and the Rocky Mountains to the east become very high, forming a barrier to the eastward-moving air masses.

The complex mountainous topography leads to a variety of climatic conditions that is reflected in the large number of biogeoclimatic units in the area. Selected climate data for some of the biogeoclimatic units are presented in Table 3.1. These data are from the few long-term climate stations in the area. It should be noted that they are all located in valley bottoms.

3.5 Vegetation

3.5.1 Upland Forest

Upland coniferous forests dominate the landscape of the study area. These forests are divided into two Biogeoclimatic Zones - the Sub-Boreal Spruce Zone (SBS), the Interior Cedar-Hemlock Zone (ICH). The Engelmann Spruce - Subalpine Fir Zone (ESSF) occurs above the ICH zone.

Forests of the SBS zone are dominated by the climatic-climax tree species Picea glauca x engelmannii (hybrid white spruce)[1] and Abies lasiocarpa (subalpine fir) in all areas except the drier SBS subzone in the Rocky Mountain Trench between McBride and Valemount. In this subzone, the seral species Pinus contorta (lodgepole pine) and the long-lived seral to climax species

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[1] The "white" spruce in this area is predominately a hybrid between Picea glauca and P. engelmannii (see Wright 1955, Garman 1957, Roche 1969, Ogilvie 1972, Fowler and Roche 1975).

TABLE 3.1. Climatic data from long-term climate stations[1] in and near the study area

			Temperature						
Station	Elevation (m)	Biogeo-climatic unit	Mean annual temp. (°C)	Mean mo. temp. May-Sept (°C)	Mean mo. temp. Jun-Aug (°C)	Mean temp. warmest mo. (°C)	Extreme maximum temp. (°C)	No. mo. mean mo. temp. 10°C	Degree Days 5°C
Prince George A	676	SBSe2	3.3	12.2	14.0	15.1	34.4	3	1199
Aleza Lake	625	SBSj	3.0	12.4	14.3	15.3	36.0	3	1194
McGregor	610	SBSf	3.5	12.5	14.3	15.3	36.1	4	M[2]
Dome Creek	648	SBSf	3.1	11.9	13.7	14.7	34.4	3	1133
McBride 4SE	722	SBSh	4.2	13.0	14.7	15.8	37.8	5	1332
Valemount	797	SBSh	3.7	12.7	14.6	15.8	40.6	4	1258
Mount Robson Ranch	869	SBSh	2.8	12.2	14.1	15.2	34.0	3	1134
McBride North	771	ICHj	4.0	12.3	14.0	15.1	33.3	4	1224
Mica Dam	579	ICHb	4.3	13.6	15.7	16.9	37.8	4	1387

TABLE 3.1. (continued)

	Temperature				Precipitation						
Station	Mean temp. coldest mo. (°C)	Extreme min.	No. mo. mean mo. temp. 0°C	Degree days 0°C	Mean Annual ppt. (mm)	Mean Annual Snowfall (cm)	Mean Seasonal ppt. May-Sept (mm)	Driest month	Total ppt. driest mo. (mm)	Wettest month	Total ppt. wettest mo. (mm)
Prince George A	-12.1	-50.0	5	1058	628.3	241.7	300.8	April	27.4	August	68.2
Aleza Lake	-12.9	-47.8	5	1115	897.2	339.4	352.6	April	36.8	December	97.9
McGregor	-11.8	-46.1	5	M[2]	963.9	327.9	383.2	April	43.4	January	103.0
Dome Creek	-12.1	-46.1	5	1019	839.8	306.8	374.3	May	46.1	August	91.3
McBride 4SE	-10.3	-46.7	5	865	625.5	218.8	251.2	April	34.4	January	69.9
Valemount	-11.0	-51.1	5	956	503.1	180.3	213.1	March	25.5	January	58.1
Mount Robson Ranch	-12.6	-36.0	5	1146	630.3	234.8	277.9	May	24.5	December	88.2
McBride North	-10.2	-39.0	5	843	678.5	208.1	289.1	February	37.0	September	75.3
Mica Dam	-9.7	-37.2	5	818	1419.0	733.6	331.6	May	55.7	December	224.3

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1. Data from Environment Canada (1980a and 1980b)
2. "M" designates missing values

Pseudotsuga menziesii (Douglas-fir) dominate the landscape, probably due to the frequency of fires. In older stands, Douglas-fir is often co-dominant with hybrid white spruce and subalpine fir. Populus tremuloides (trembling aspen) is also an important seral species, especially on finer-textured soils. Betula papyrifera (paper birch) is a component of most seral stands. Populus balsamifera (cottonwood) stands, usually with a component of hybrid white spruce, are common along the active floodplains of rivers and major streams.

Forests of the ICH are dominated by the climatic climax tree species Thuja plicata (western redcedar) and Tsuga heterophylla (western hemlock), often with minor components of both hybrid white spruce and subalpine fir. Seral stands are relatively uncommon throughout most of the ICH in this area, with trembling aspen, paper birch and Douglas-fir being the most common seral species. Lodgepole pine is a less common seral component. Both western redcedar and western hemlock regenerate well after disturbance and often form a component of seral stands. Pinus monticola (western white pine) is a seral species in the southern portion of the ICH, but reaches its northern limit at Valemount.

The subalpine forests (ESSF) are dominated by extensive stands of Picea engelmannii (Engelmann spruce) and Abies lasiocarpa, which are the climatic climax tree species. Lodgepole pine is the most common seral species, often in combination with Engelmann spruce and subalpine fir. Trembling aspen and paper birch are uncommon seral species in the ESSF. Pinus albicaulis (whitebark pine) occasionally occurs in the area. At the upper elevations of the ESSF, in an area that is transitional to the Alpine Tundra Zone (AT), subalpine fir (and occasionally Engelmann spruce) forms clumped, stunted stands often referred to as the krummholz or parkland.

3.5.2 Wetlands

Wetlands are common in the valley bottom of the Rocky Mountain Trench in both postglacial depressions and river ox-bows of the ICH and SBS. Wetland types include: *Carex* "marshes"; shrub "fens" of *Betula glandulosa*, and *Salix* spp.; treed fens and swamps of *Picea mariana* (black spruce), *Pinus contorta*, *Picea glauca* x *engelmannii*, *Thuja plicata* and/or *Tsuga heterophylla*; and *Picea mariana* or *Pinus contorta* - *Sphagnum* "bogs". Nutrient-poor bogs, and treed fens and swamps are the most common wetlands, although upland forests still dominate the landscape.

Wetlands are uncommon above the valley bottom.

3.5.3 Aquatic Vegetation

Aquatic and semi-terrestrial vegetation develops along the margins of many streams and lakes, although lakes are uncommon in this area. No sampling was done in aquatic vegetation due to the bias towards terrestrial vegetation.

3.5.4 Alpine Vegetation

Alpine tundra vegetation dominates the high elevations in both the Columbia and Rocky Mountains. Although the alpine was not sampled in this study, a number of observations have been made.

A wide variety of alpine ecosystems occur in this area. The most common ecosystems in the northern part of the area are herb meadows dominated by *Erigeron peregrinus*, *Artemisia arctica*, *Veratrum viride*, *Valeriana sitchensis*, *Arnica* spp., *Poa* spp. and *Luetkea pectinata*. *Salix* spp. shrub communities are common on lower elevation wet sites. The driest windswept ridges are dominated by *Dryas* spp. and *Potentilla* spp.

In the southern part of the study area in the Rocky Mountains, heather communities, dominated by Phyllodoce spp., Cassiope spp., Antennaria lanata and Poa spp., are the most common alpine ecosystems.

3.6 Soils

The major factors influencing soil development are climate, biota, topography, parent materials, and time (Jenny 1941). One of these factors may dominate the development of a particular soil, or more commonly, several factors will operate simultaneously, with the relative importance of each factor varying from soil to soil. General trends in soil development within the study area are discussed with respect to the influence of these major soil forming factors.

Soils that occur on the present-day landscape may be arranged into a classification system that is based on their inherent properties. Such a system has been developed for Canadian soils (Canada Soil Survey Committee 1978). The classification of soils that occur on the general landscape within the study area is described down to the subgroup level of the Canadian system of soil classification.

3.6.1 Mineral Soils

The most common soils developed on medium- and coarse-textured morainal deposits are Orthic Humo-Ferric Podzols and Eluviated Dystric Brunisols. Podzols are characterized by subsurface "B" horizons in which the dominant accumulation product is an amorphous organic matter - iron or aluminium complex (Canada Soil Survey Committee 1978). Brunisolic soils are not as well developed as soils of other orders, lacking certain specific horizon characteristics. The combined factors of parent materials, cold humid to perhumid soil climates, and coniferous forest cover create typical conditions for the development of podzolic soils (Valentine and Lavkulich 1978). With increasing elevation and precipitation, podzols become more common than brunisols.

Soils receiving seepage are usually gleyed subgroups, whereas those in the depressions are gleysols. Gleysolic soils have features indicative of prolonged saturation with water, which results in reducing conditions close to the surface; gleyed subgroups of other orders have features indicating fluctuating water table, seepage, or reducing conditions at depth.

When morainal deposits have a higher clay content, soils are usually Podzolic or Brunisolic Gray Luvisols. Luvisols have subsurface "B" horizons in which clay has accumulated, and the parent materials of these soils are often less acidic than those on which podzols develop. Again, where these soils are in receiving positions, they are commonly gleyed subgroups and imperfectly drained.

On glaciofluvial materials, which are usually course-textured and rapidly pervious, the most common soils are Orthic Humo-Ferric Podzols and Eluviated Dystric Brunisols. In seepage sites, soils may be gleyed subgroups, although due to their course texture, they are often sufficiently well aerated to prevent development of reducing conditions.

The most common soils found on lacustrine deposits are Orthic, Brunisolic, and Podzolic Gray Luvisols, with the trend from orthic to podzolic subgroup following that of increasing precipitation. Many of these soils are gleyed. Where there is permanent saturation, either in depressions or through seepage, Orthic, Luvic, or Humic Gleysols develop.

Soil development on the fluvial deposits varies with their age, moisture status, and texture. Soils on the older (inactive) fluvial materials are commonly Orthic Humo-Ferric Podzols or Eluviated Dystric Brunisols. Soils influenced by fluctuating water tables are commonly gleyed subgroups; those with permanent seepage or water table, commonly Orthic and Humic Gleysols. Soils on more recent fluvial deposits, which are often inundated by floods, are commonly Orthic, Cumulic, or Humic Regosols or Orthic (Eutric or Dystric) Brunisols. Again, they may be gleyed or if permanently saturated, Orthic, Humic, or Reyo Gleysols.

Eolian deposits are primarily found in the relatively dry Valemount area, where they represent the driest sites. Soils dominantly develop into Orthic or Eluviated Dystric Brunisols. Where the eolian sands occur as veneers over less pervious material, the soils are often Orthic Humo-Ferric Podzols and Podzolic Gray Luvisols.

Colluvial deposits commonly occur at higher elevations, and in the mountain ranges, where precipitation is higher. Consequently, soil development is more advanced. Because of both the high precipitation and their characteristically rubbly nature, which leads to relatively high percolation of water through the soil profile, the most common soils on these deposits are Orthic Humo-Ferric Podzols. Colluvial veneers are lithic phases of these soils. On drier slopes and on more recent colluvium, both Dystric and Eutric Brunisols occur.

3.6.2 Organic Soils and Humus Forms

3.6.2.1 Organic Soils

The dominant soils that have developed on forested organic deposits are Mesisols. These soils are at an intermediate stage of decomposition. Less developed Fibrisols are the subdominant organic soils in the study area. Where organic deposits are less than 160 cm. deep, which is common in the area north of Dome Creek, Terric Mesisols and peaty phases of Gleysols develop. On bedrock knolls, where the organic materials overlie unweathered bedrock, Folisols may occur.

3.6.2.2 Humus Forms

Humus form refers to the horizons located at or near the soil surface, which have formed from the organic residues. They are commonly referred to as "duff layers".

Both Mor and Moder humus forms are common throughout the study area. Mor humus, where decomposition is relatively slow and is dominated by fungal activity, is common on dry sites and where the tree litter is very acid, e.g. pure hemlock stands. Moder humus, where decomposition is more rapid and is dominated by soil fauna, yet without significant intermixing of organic matter and mineral soil, is more common on moist to wet sites where the shrub litter is more abundant (providing more easily decomposable litter); or where there is a significant component of cedar in the tree layer (cedar litter contains relatively large amounts of calcium, which encourages faunal activity).

Mull humus forms, where organic matter is incorporated into the upper mineral horizons (Ah horizons), are much less common than mors and moders. They often occur where there is a strong component of deciduous trees in the stand, especially on recent fluvial deposits. Decomposition on these sites is very rapid relative to Moder and Mor humus forms.

4.0 BIOGEOCLIMATIC ZONES AND SUBZONES

Four biogeoclimatic zones are found in the study area (Table 4.1). These are the Sub-Boreal Spruce Zone (SBS), the Interior Cedar - Hemlock Zone (ICH), the Engelmann Spruce - Subalpine Fir Zone (ESSF) and the Alpine Tundra Zone (AT). In general, the SBS is found in the valley bottoms along the major rivers, the ICH above the SBS to approximately 1300m (above sea level), the ESSF between approximately 1300 and 2000m, and the AT above the ESSF. A cross section of the Rocky Mountain Trench at Goat River (Figure 4.1) demonstrates this distribution of biogeoclimatic units.

In the driest part of the Rocky Mountain Trench near Valemount, the lower elevations of the southwest facing slope is SBS, whereas the northeast facing slope is ICH. Figure 4.2 depicts this distribution of biogeoclimatic units at Valemount.

Table 4.2 differentiates the four biogeoclimatic zones using vegetation characteristics of climax, broadly circum-mesic ecosystems.

Appendix 7 includes copies of the 1:250 000 scale biogeoclimatic unit maps for the study area.

4.1 Interior Cedar - Hemlock Zone (ICH)

The ICH zone in southeastern British Columbia extends from the United States border to roughly 50^{0} 10' N. latitude. One subzone of the ICH zone (ICHg) is located in west central B.C. from 54^{0} 45' to 57^{0} N latitude in the Nass basin and adjacent Hazelton and Skeena Mountains (Haeussler et. al. 1981).

The ICH zone in southeastern B.C. has been classified as the Columbia Forest Region by Rowe (1972). He included the ICH that is in our study area in the Northern Columbia section. Krajina (1965, 1972) termed this zone the Interior Western Hemlock Zone,

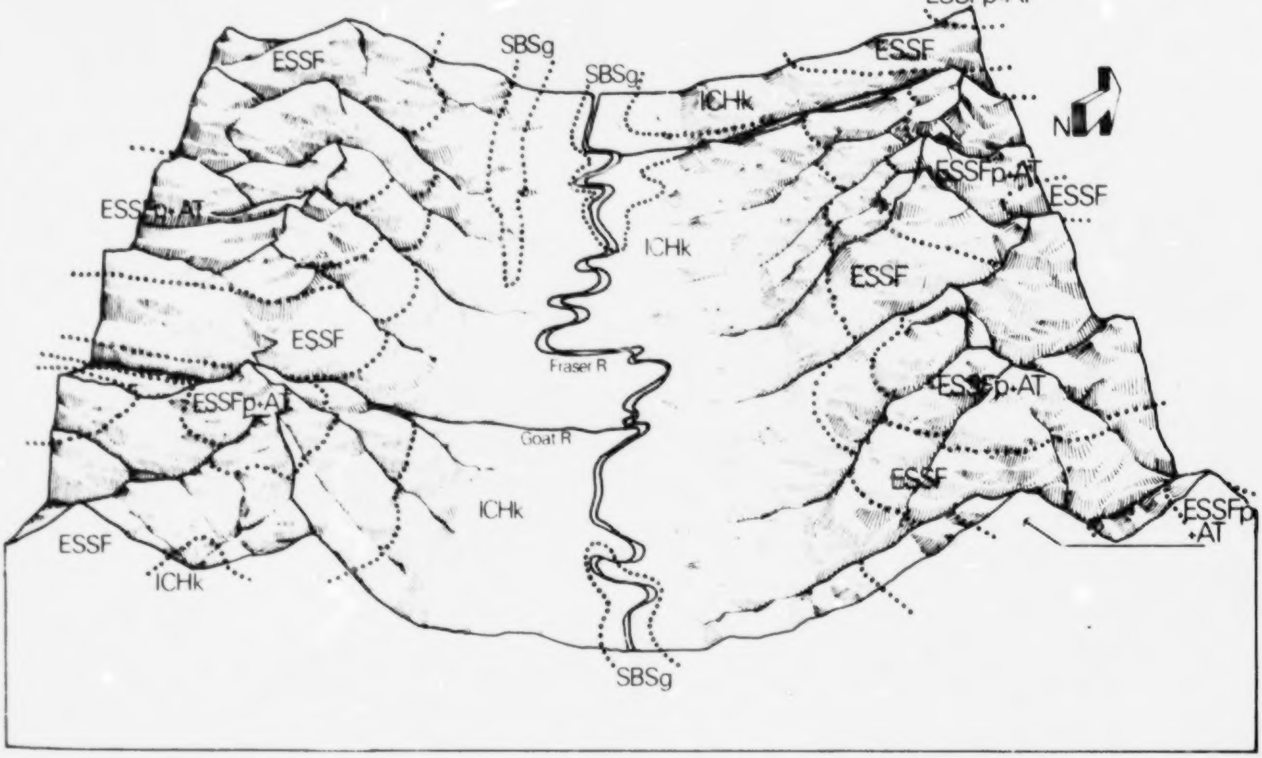
ESSFp-AT
SBSg
ESSF
SBSg
ICHk
ESSF
N
ESSFp-AT
ESSF
ESSFp-AT
ICHk
ESSF
ESSF
Fraser R
ESSFp-AT
ESSFp-AT
Goat R
ESSF
ICHk
ESSFp-AT
ESSF
ICHk
SBSg

FIG. 4.1. Cross section of the Rocky Mountain Trench near Goat River.

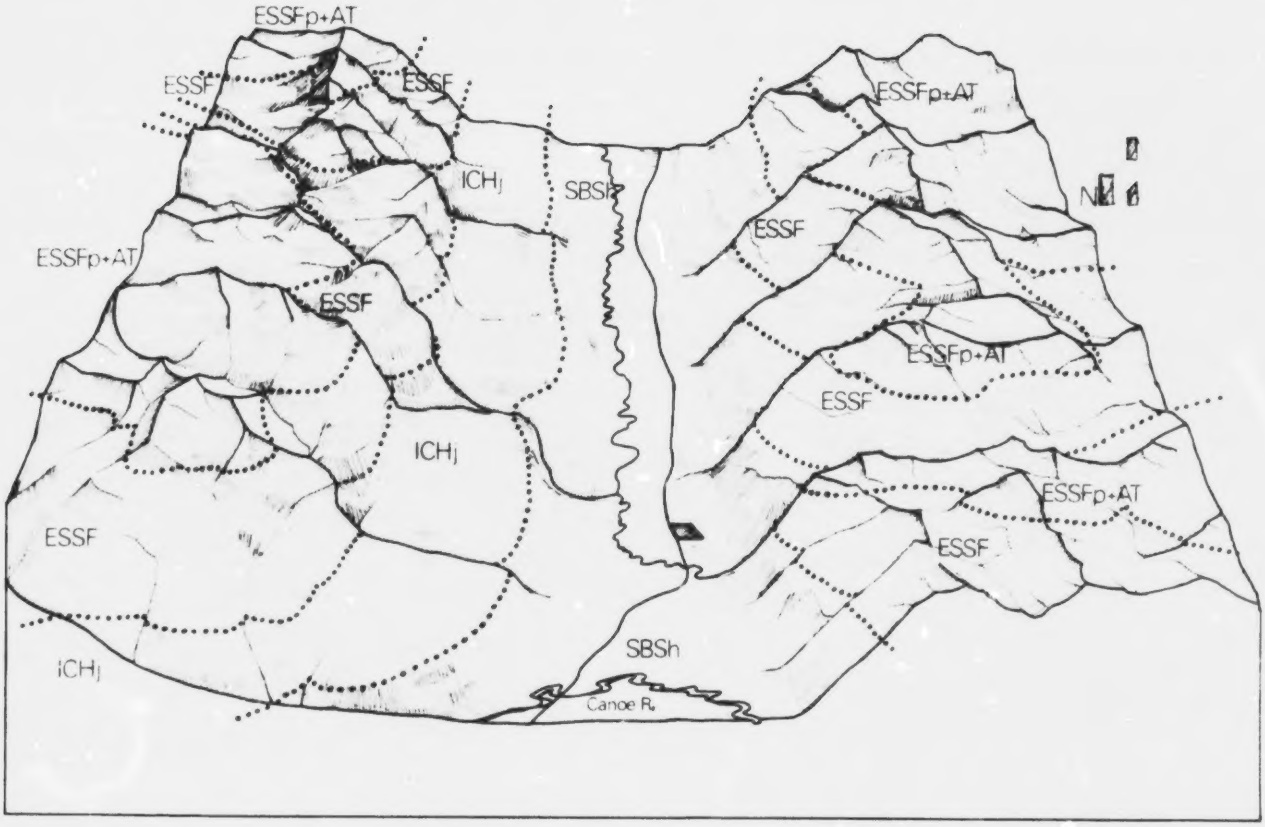
ESSFp+AT
ESSF
ESSF
ICHj
SBSh
ESSFp+AT
ESSF
ESSFp+AT
ESSF
ICHj
ESSF
ICHj
SBSh
Canoe R.
ESSF
ESSFp+AT
ESSF
ESSFp+AT
ESSF
N

FIG. 4.2. Cross section of the Rocky Mountain Trench near Valemount.

TABLE 4.1. Biogeoclimatic units in the Rocky Mountain Trench area of the Prince George Region

Biogeoclimatic zone	Biogeoclimatic subzone	
Interior Cedar - Hemlock (ICH)	ICHb	Wet Interior Cedar - Hemlock
	ICHf	Very Wet Northern Interior Cedar - Hemlock
	ICHj	Moist Northern Interior Cedar - Hemlock
	ICHk	Wet Northern Interior Cedar - Hemlock
Sub-Boreal Spruce (SBS)	SBSf	Very Wet Rocky Mountain Sub-Boreal Spruce
	SBSg	Moist Rocky Mountain Sub-Boreal Spruce
	SBSh	Dry Rocky Mountain Sub-Boreal Spruce
Engelmann Spruce - Subalpine Fir (ESSF)	ESSFb	Wet Forested Engelmann Spruce - Subalpine Fir
	ESSFbp	Wet Parkland Engelmann Spruce - Subalpine Fir
	ESSFo	Moist Rocky Mountain Forested Engelmann Spruce - Subalpine Fir
	ESSFop	Moist Rocky Mountain Parkland Engelmann Spruce - Subalpine Fir
	ESSFh	Wet Central Forested Engelmann Spruce - Subalpine Fir
	ESSFhp	Wet Central Parkland Engelmann Spruce - Subalpine Fir
Alpine Tundra (AT)	undifferentiated	

TABLE 4.2. Differentiating combination of species for forested biogeoclimatic zones in the study area

Species[1]	Biogeoclimatic zone[2]		
	SBS	ICH	ESSF
Climatic climax tree species:			
Thuja plicata	+[3]	****	+
Tsuga heterophylla	+	***	+
Pseudotsuga menziesii	**	+	
Abies lasiocarpa	***	**	****
Picea glauca x *engelmannii*	****	*	
Picea engelmannii			****
Shrubs:			
Rosa acicularis	**	+	
Spiraea betulifolia	**	+	+
Amelanchier alnifolia	**	+	
Lonicera involucrata	***	*	*
Viburnum edule	***	*	+
Rubus parviflorus	****	**	*
Oplopanax horridus	**	****	*
Acer glabrum	*	**	+
Vaccinium ovalifolium	*	***	**
Vaccinium membranaceum	***	***	****
Menziesia ferruginea	*	**	****
Rhododendron albiflorum	+	+	***
Herbs:			
Oryzopsis asperifolia	*		
Calamagrostis rubescens	*		
Chimaphila umbellata	**	*	+
Aralia nudicaulis	**	**	+
Athyrium filix-femina	**	**	+
Galium triflorum	***	***	+
Dryopteris assimilis	***	***	*
Smilacina racemosa	***	***	*
Gymnocarpium dryopteris	***	****	**
Goodyera oblongifolia	**	****	+
Valeriana sitchensis	*	+	**
Luetkea pectinata			**
Phyllodoce empetriformis			**
Cassiope mertensiana			*

TABLE 4.2 (continued)

Species[1]	Biogeoclimatic zone[2]		
	SBS	ICH	ESSF
Mosses, liverworts and lichens:			
Rhytidiadelphus triquetrus	***	***	+
Ptilium crista-castrensis	***	****	****
Hylocomium splendens	**	****	***
Barbilophozia lycopodioides	+	+	****
Dicranum fuscescens			***
Barbilophozia floerkei			**
Cladonia ecmocyna			***

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[1] Only those species occuring in mature seral to climax ecosystems on submesic, mesic and subhygric sites *and* found to be useful for differentiating the zones in the study area are used.

[2] Table 4.1 list the subzones of each zone in the study area.

[3] Relative abundance in the zone (applicable to study area only): +-rare; *-uncommon; **-common; ***-widespread; ****-widespread and dominant.

and considered this northern area as part of the wetter subzone. A number of studies have described the vegetation and/or soils of the ICH outside the study area (Smith 1963, 1965; Bell 1964, 1965; Hamet-Ahti 1965; Jones 1978; Utzig 1978; Clement 1980; Jungen 1980; Vold et. al. 1980; Wittneben 1980). The British Columbia Ministry of the Environment studied the vegetation and soils of a section of the present study area in 1977 (Ceska 1979; Comeau and Comeau 1983).

This manual describes four subzones of the Interior Cedar - Hemlock Zone in the Prince George Forest Region. There are ten other subzones described to date in B.C. These are the ICHa, ICHc, and ICHd (Utzig et. al. 1982), the ICHh (Steen[1], personal communication), ICHe (Coupe and Yee 1982), ICHg (Haeussler et al. 1981), and ICHm, ICHn, ICHv, ICHw (Lloyd 1983).

4.1.1 Wet Interior Cedar - Hemlock (ICHb)

4.1.1.1 Location

The ICHb is restricted to a small portion of the Prince George Region along Kinbasket Lake, south of Hugh Allen Creek (52^{0} 25' N). This subzone occurs over a large part of the Nelson Region north of 50^{0} 30' N. (Utzig et. al 1982).

The elevational range of the subzone in the Prince George Region is from 710-1370 m.

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[1] Steen, O., Regional Ecologist, Ministry of Forests, Williams Lake, B.C.

4.1.1.2 Climate

The climate of the ICHb is considerably moister than the other ICH subzones in the study area (see Table 4.3). This is primarily due to the high snowfall, because as Table 4.3 shows, seasonal precipitation is comparable to the other ICH subzones (except for the ICHf, which has significantly greater seasonal precipitation than the ICHb,j, or k). The high snowfall has implications for species selection and harvesting methods, as well as soil moisture conditions during the early part of the growing season.

Temperature comparison with the other ICH subzones is not possible because of limited data. It is likely, however, that the growing season would be longer in the ICHb because of its more southerly latitude.

Table 4.3 shows that the ICHb is both drier and warmer than the ESSF above it (ESSFb).

4.1.1.3 Vegetation

Western redcedar and western hemlock are the dominant climax coniferous tree species in the ICHb. Hybrid white spruce and subalpine fir are common in many ecosystems, tending to dominate sites influenced by cold air. Although Tsuga mertensiana (mountain hemlock) occurs occasionally in the subzone further south, it is not found in the Prince George Region. Douglas-fir and western white pine are important seral trees species primarily on drier associations. Cottonwood is commonly found on fluvial floodplains while paper birch is uncommon.

The zonal plant association for this subzone is characterized as a Rubus - Athyrium association and is dominated by species such as Thuja plicata, Tsuga heterophylla, Oplopanax horridus, Rubus parviflorus, Athyrium filix-femina, Gymnocarpium dryopteris, and

TABLE 4.3: Summary climate data for biogeoclimatic subzones[1,2]

Biogeoclimatic unit		Sample size for ppt.	Seasonal ppt. May-Sept (mm)		Annual ppt. (mm)		Sample size for temp.	Seasonal mean temp. May-Sept (°C)		Annual mean temp. (°C)	
Zone	Subzone		Mean	Range	Mean	Range		Mean	Range	Mean	Range
SBS	SBSh	16	235	189-277	555	449-662	3	12.6	12.2-13.0	3.6	2.8-4.2
	SBSg	1	330		705		1	12.4		4.2	
	SBSf	7	424	353-496	1153	931-1404	4	11.5	10.3-12.5	2.6	1.5-3.5
ICH	ICHb	6	369	309-480	1510	1229-1730	3	12.0	11.0-13.6	3.1	2.1-4.4
	ICHj	3	300	241-330	645	556-785	2	12.5	11.9-13.1	4.2	
	ICHk	6	381	371-405	848	829-880					
	ICHf	5	462	399-517	1065	908-1356	1	11.6		3.4	
ESSF	ESSFb	3	510	414-587	2071	1677-2402	3	8.3	7.1-9.9	0.3	-0.1-1.5
	ESSFo	1			881		1	8.3		1.0	
	ESSFn	4	441	302-561	1098	721-1422	4	7.5	6.4-9.0	0.1	-0.8-2.1
AT		2	417	340-490	1031	815-1250	2	5.4	4.2-6.6	-1.5	-1.3-1.6

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1 Much of the data are from "remote" stations. The data from remote stations are "normalized" to a base station by Air Studies Branch, B.C. Ministry of Environment.

2 Data from Environment Canada (1980*a*) and B.C. Ministry of Environment.

Mnium spp. The mesic vegetation is characterized by lush shrub and herb layers with high cover. The herb layer contains a variety of fern and lily family species. The moss layer is generally poorly developed. Table 4.4 compares the mesic vegetation of this subzone with that of other ICH subzones in the area.

A number of species are common in the ICHb that are absent or uncommon in the other ICH subzones in the study area (ICHj, ICHk, ICHf). These are Lonicera utahensis, Taxus brevifolia, and Rhytidiopsis robusta, as well as mountain hemlock.

Wetlands are uncommon in the Prince George Forest Region section of the subzone, there being only one known extensive area that occurs between Howard and Foster Creeks.

Detailed descriptions of the the ecosystem units described by Utzig et. al. (1982) are presented in Section 6.1.

4.1.1.4 Surficial Materials and Soils

Within the Prince George Region, the surficial deposits are dominantly morainal and colluvial. Less common are fluvial and glaciofluvial and of minor importance, lacustrine and organic.

Morainal deposits are extensive on the walls of the Rocky Mountain Trench. Soils developed on these deposits are relatively coarse-textured (sandy loam to sandy clay loam) and on well and moderately well drained sites, soil development produces an Orthic Humo-Ferric Podzol. Ferro-Humic Podzols also may occur, increasing in frequency with elevation and southerly latitude.

Colluvial deposits are also common on the steep-walled trench. The texture of these deposits depends on the source of the material, although those most commonly occurring are moderately coarse- to coarse-textured. Soil development is similar to that on morainal deposits.

TABLE 4.4. Characteristic combination of species for zonal associations[1] of the Interior Cedar - Hemlock subzones in the study area

Species[2,3]	Biogeoclimatic subzone			
	ICHb	ICHf	ICHk	ICHj
Trees:				
Tsuga heterophylla	**[4,5,6]	+	**	***
Thuja plicata	**	***	***	**
Abies lasiocarpa	+	+	*	**
Picea glauca x *engelmannii*	+	+	+	**
[*Pseudotsuga menziesii*][3]				+
Shrubs:				
Lonicera utahensis	+			
Oplopanax horridus	***	***	*	*
Acer glabrum	+	*	*	+
[*Ribes lacustre*]	*	*	*	*
[*Rubus parviflorus*]	*	*		*
[*Vaccinium membranaceum*]	*	+	*	*
[*Vaccinium ovalifolium*]	*	+	*	*
Menziesia ferruginea	+		*	**
Spiraea betulifolia				*
Herbs:				
Circaea alpina	*	*		
Athyrium filix-femina	**	**	*	
Viola spp.	*	*	+	+
Actaea rubra	*	*	+	
Disporum hookeri	*	*	+	
Dryopteris assimilis	**	**	*	*
Galium triflorum	*	*	*	
Gymnocarpium dryopteris	*	***	***	*
[*Goodyera oblongifolia*]	*	*	*	*
[*Streptopus amplexifolius*]	*	*	*	*
[*Streptopus roseus*]	*	*	*	*
[*Clintonia uniflora*]	*	*	*	*
[*Cornus canadensis*]	*	*	**	*
[*Rubus pedatus*]	*	*	**	*
Lycopodium annotinum	+	+	*	+
Aralia nudicaulis	+	+	*	*
Mitella nuda		+	*	+
Moneses uniflora		+	*	+
Orthilia secunda	+	+	*	*
Chimaphila umbellata		+	+	*

TABLE 4.4 (continued)

Species[2]	Biogeoclimatic subzone			
	ICHb	ICHf	ICHk	ICHj
Herbs: continued				
Goodyera repens		+	+	*
Pyrola chlorantha			+	*
Maianthemum canadense			+	*
Mosses:				
Mnium spp.	**	**	*	+
Brachythecium spp.	**	+	*	+
Rhytidiopsis robusta	+	+		
Hylocomium splendens		*	***	***
Pleurozium schreberi	+	+	**	**
Ptilium crista-castrensis	+	+	**	**
Rhytidiadelphus triquetrus		+	**	**

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[1] Zonal association is defined in Chapter 2.

[2] Only those species occuring in maturing seral to climax ecosystems are used.

[3] Species that are bracketed ⌊⌋ have approximately the same occurence and cover throughout the four subzones but are part of the characteristic combination species for zonal associations.

[4] Relative occurence in the subzone: +-uncommon; *-common.

[5] Average cover of common species: *-low; **-moderate; ***-high.

[6] Missing symbols indicate that species was not present or very rare.

Fluvial deposits are restricted to the narrow valleys that emerge from the mountains on either side of the Trench. Fluvial fans are common where steep-sloped streams intersect the valley bottoms. Glaciofluvial deposits are small and scattered, often being associated with morainal deposits.

4.1.2 Moist Northern Interior Cedar - Hemlock (ICHj)

4.1.2.1 Location

The ICHj occurs on the lower valley walls above Kinbasket Lake from Hugh Allen Creek to Valemount, on the southwest side of the valley between Albreda and Dunster, and again on both walls of the trench between Dunster and the McKale River.

The elevational range is from 710 to 1370 m.

4.1.2.2 Climate

The ICHj is the driest of the ICH subzones in the Prince George Region (Table 4.3). Although the seasonal precipitation is only slightly less than that of the ICHb, the annual precipitation is much less because of the greater snowfall in the more southern subzone. The ICHj is also drier than the ICHk because it occurs in an area of greater rainshadow due to the Premier Range to the west. The ICHj is drier, has a longer growing season, and has warmer temperatures than the ESSF subzones above it (ESSFo).

4.1.2.3 Vegetation

The dominant climax tree species in the ICHj are western redcedar and western hemlock. They are co-dominant in most stands with minor components of hybrid white spruce and subalpine fir. Douglas-fir, lodgepole pine, and trembling aspen are the most common seral species. Western white pine is uncommon, reaching its northern limit in this subzone. Paper birch is scattered throughout the subzone while cottonwood is relatively uncommon.

There are more seral stands in this subzone of the ICH than any other for two possible reasons: the drier climate leads to drier forest fuel during the summer lightning season; and a number of fires were lit during the railroad construction approximately 60 years ago.

The zonal plant association of the ICHj is characterized as a Menziesia - Clintonia association and is dominated by species such as Tsuga heterophylla, Thuja plicata, Menziesia ferruginea, Clintonia uniflora, Cornus canadensis, Pleurozium schreberi, Hylocomium splendens, and Ptilium crista-castrensis. The mesic vegetation has a poorly developed shrub layer and a poorly to moderately developed herb layer. The moss layer is always well developed. Table 4.4 compares the vegetation of the zonal association with that of the other ICH subzones.

Wetlands are rare is this subzone. This is due to the position of this subzone on the landscape: because it is located primarily on valley walls, there are very few poorly drained sites.

The ecosystem units classified in the ICHj are described in Section 6.2.

4.1.2.4 Surficial Materials and Soils

The most extensive surficial deposits in this subzone are morainal in origin. Intermixed with this material are glaciofluvial and fluvial materials. On steep slopes and at higher elevations, colluvium is common.

Morainal deposits occur over a large area on the walls of the Rocky Mountain Trench within the subzone. Soils developed on these deposits are commonly sandy loam to sandy clay loam in texture, although pockets of finer-textured material (clay loam to silty clay loam) do occur. On the moderately coarse-textured, well drained sites, modal soil developed is an Orthic Humo-Ferric Podzol. On the finer-textured sites, modal soil development is an Orthic or Brunisolic Gray Luvisol.

Because many of the streams in the subzone have a steep gradient and are snow-fed, fluvial deposits are commonly fluvial fans. They are usually coarse-textured, have moderate to high coarse fragment content, and may receive intermittent seepage. On moderately well drained sites, soils are Orthic Humo-Ferric Podzols.

Both colluvial and glaciofluvial deposits are common but not extensive. When well-drained, soils on both types of deposits are moderately coarse- to coarse-textured Orthic Humo-Ferric Podzols. Organic and lacustrine deposits are rare in this subzone.

4.1.3 Wet Northern Interior Cedar - Hemlock (ICHk)

4.1.3.1 Location

The ICHk occurs on the lower walls and in the valley floor of the Rocky Mountain Trench between McBride and Dome Creek, except on the lowest terraces of the major rivers. It also enters the valleys of most drainages flowing into the Fraser River.

The elevation ranges from 690 to 1370 m.

4.1.3.2 Climate

The climate of the ICHk is moister than the ICHj, but drier than the ICHf (Table 4.3). Precipitation differences between the ICHk and ICHj may be compounded by a lower evaporative demand due to the increased cloud cover and humidity, as well as increasing latitude.

The ICHk has a longer growing season, less snowpack, and warmer temperatures than the ESSF above (ESSFn). The SBS below (SBSg) has a similar climate to the ICHj but, as it occupies the lowest valley bottoms, it is influenced by cold air drainage.

4.1.3.3 Vegetation

Western redcedar and western hemlock are the dominant climax tree species. They often occur as co-dominants, with minor components of hybrid white spruce and subalpine fir. Douglas-fir is a long-lived seral species that is occasionally present on mesic or drier sites. Seral stands are rare in this subzone. Trembling aspen, paper birch and Douglas-fir are the main seral species. Lodgepole pine is occasionally present as a seral species, but is primarily found on the very driest and wettest ecosystems. Lodgepole pine and *Picea mariana* (black spruce) are present in the bogs in this subzone.

The zonal plant association is characterized as a *Gymnocarpium* - *Hylocomium* association and is dominated by species such as *Thuja plicata*, *Tsuga heterophylla*, *Oplopanax horridus*, *Gymnocarpium dryopteris*, *Hylocomium splendens*, *Rhytidiadelphus triquetrus*, *Pleurozium schreberi*, and *Ptilium crista-castrensis*. The mesic vegetation is characterized by a moderately developed shrub layer and a well developed herb and moss layer. Table 4.4 compares the vegetation of the zonal association with that of other ICH subzones.

Wetlands are relatively uncommon in this subzone and are primarily forested swamps and bogs over lacustrine material.

The ecosystem units classified in the ICHk are described in Section 6.3.

4.1.3.4 Surficial Materials and Soils

The most extensive surficial deposits in this subzone are morainal or lacustrine in origin. Less extensive areas of colluvial, glaciofluvial, fluvial, and organic deposits also occur.

Lacustrine deposits are very extensive on the floor of the Rocky Mountain Trench and also occur in the Morkill River valley. Texture of soils on these deposits is usually silty clay to clay, although fine sandy loam to fine sand textures also occur. On the moderately well drained sites, soils are usually Orthic Grey Luvisols. Areas of Gleyed Grey Luvisols are very common in this subzone. In poorly drained areas, these lacustrine deposits are often complexed with, and overlain by, organic soils. These organic soils are usually Typic Mesisols or Fibrisols.

Morainal deposits are extensive on the southwest side of the trench, or mixed with colluvium on the northeast side. Soils are usually loamy to sandy clay in texture, have fifteen to thirty percent coarse fragments, and on moderately well to well drained sites, are Brunisolic Gray Luvisols. Soils coarser than loam are also common and are usually Orthic Humo-Ferric Podzols. Colluvium often overlies or is mixed with these morainal deposits. Textures of colluvially derived soils are generally loamy to loamy sand and the soil developed is an Orthic Humo-Ferric Podzol.

Glaciofluvial and fluvial deposits often occur as a complex with, or as a veneer over, the lacustrine material. They are generally Orthic Humo-Ferric Podzols, with a sandy loam to silt loam texture. Fluvial fans, although not extensive, are common where streams from the steep valley walls enter the floor of the trench.

4.1.4 Very Wet Northern Interior Cedar - Hemlock (ICHf)

4.1.4.1 Location

The ICHf is, in general, located on the lower valley walls above the Fraser River between Dome Creek and the Bowron River; above Slim

Creek between the Fraser River and Tumuch Lake; and above Walker Creek/Goodson Creek between the McGregor and Torpy Rivers. This subzone is also located on the southwest aspects above the McGregor River between Mount Sir Alexander and Gleason Creek, and above the Torpy River on the lower slopes of the McGregor Range and Bearpaw Ridge.

The elevational range is between 690 and 1370 m.

4.1.4.2 Climate

The climate of the ICHf is moister than the the ICHk (Table 4.3). It is in this subzone that easterly moving air masses first encounter high mountains after passing over the Interior Plateau. This area receives more precipitation and associated cloud cover than any area to the west or east, although the ICHf receives less precipitation than the ESSF above it (ESSFn).

The ICHf occurs above the SBSf in many of the valleys and adjoins the SBS to the west. The climate of the adjacent SBS is likely more continental, that is, it is influenced by greater temperature extremes, and has lower average temperatures.

The important parameter influencing the pattern of the ICHf and SBS seems to be temperature, but little climate data exist for comparison.

4.1.4.3 Vegetation

Western redcedar and western hemlock are the dominant climax tree species in the ICHf. Although they are codominant on many sites, redcedar dominates mesic and wetter sites and hemlock dominates the driest sites. Hybrid white spruce and subalpine fir are usually present as minor components on most ecosystems. Seral ecosystems are rare in this subzone. Douglas-fir, often hundreds of years old, is present on some drier and/or richer sites. Trembling aspen, paper birch and Douglas-fir are the most common seral species. Cottonwood is present as a minor seral component of wetter ecosystems. Lodgepole pine is usually found with black spruce in bogs.

The zonal plant association is characterized as an *Oplopanax* - *Gymnocarpium* association and is dominated by species such as *Thuja plicata*, *Oplopanax horridus*, *Gymnocarpium dryopteris*, *Athyrium filix-femina*, and *Mnium* spp. The mesic vegetation is characterized by a well-developed shrub layer dominated by devil's club, a well-developed, lush herb layer, and a poorly developed moss layer. Table 4.4 compares the vegetation of the zonal association with that of other ICH subzones.

Wetlands, which are uncommon, are primarily forested swamps and bogs.

The ecosystem units of the ICHf are described in Section 6.4

4.1.4.4 Surficial Materials and Soils

The most common surficial deposits in this subzone are morainal and glaciofluvial. Less extensive, but still relatively common, are colluvial and lacustrine deposits and fluvial fans.

Morainal deposits are quite extensive on the walls of the Rocky Mountain Trench and the slopes of the McGregor Plateau uplands. Soils on these deposits are either medium-textured (loam to sandy clay) or coarser (sandy loam to sand). The coarser-textured deposits may be ablation moraine deposits. Coarse fragment content of the morainal deposits is in the range of twenty to fifty percent. Soils developed are usually Orthic Humo-Ferric Podzols (coarse-textured) or Brunisolic Gray Luvisols (medium- to fine-textured). Extensive areas of gleyed morainal soils on lower slopes occur in the subzone.

Glaciofluvial sediments are extensive on the floor of the trench. They are often sandy (to loamy) in texture, with a low coarse fragment content. They generally overlie lacustrine sediments, with their depth usually being greater than one metre. They are usually well to moderately well drained and typical soil development is an Orthic Humo-Ferric Podzol.

Colluvial deposits are scattered along the valley walls throughout the subzone, often intermixed with morainal deposits. Soils on these deposits are generally loamy to loamy sand in texture and soil development on well to moderately well drained sites is that of an Orthic Humo-Ferric Podzol.

Lacustrine sediments are not extensive in area but occur commonly at the foot of the trench walls. They are deposited at higher elevations than the glaciofluvial and fluvial sediments but are generally lower than, or complexed with, morainal deposits. Soils on these lacustrine deposits are fine-textured, silt loam to clay or silty clay, and moderately well drained or wetter. On moderately well-drained sites, soils are usually Brunisolic Gray Luvisols; a considerable percentage of the lacustrine soils are gleyed.

Fluvial fans are common where streams draining high elevation areas enter the valley floors. Many of these fans overlie lacustrine material, as do the forested organic deposits in the subzone. Forest organic soils are generally Typic Mesisols.

4.2 Sub-Boreal Spruce Zone (SBS)

The SBS occurs between approximately 52^{0} and 57^{0} N latitude in the central interior of British Columbia. Rowe (1972) included this area in his Montane and Subalpine Forest Regions. We follow Krajina's (1965) concept of the SBS as the southernmost zone of the Canadian Boreal Forest Region in British Columbia, but following the work of Annas and Coupe (1979), the SBS is currently considered as broadly transitional between the true montane forests of Douglas-fir to the south, boreal forest to the north, and subalpine forest at higher elevations.

The SBS zone is still incompletely studied. Pojar et. al. (1984) have described the SBS subzones in the Prince Rupert Forest Region (primarily SBSd and SBSe) and Coupe and Yee (1982) have described the SBSc in the Cariboo Region. The classification is still being developed for other subzones of the SBS in the Kamloops, Cariboo and Prince George Forest Regions. This manual describes in detail one subzone of the SBS (the SBSh), and provides some general comments on two others, namely the SBSf and SBSg.

4.2.1 Dry Rocky Mountain Sub-Boreal Spruce (SBSh)

4.2.1.1 Location

The SBSh is found in the valley bottom of the Rocky Mountain Trench between Albreda and McBride, and the lower elevations of the northeast wall of the trench between Valemount and Dunster.

The elevation ranges from a minimum of about 700 m along the Fraser River to approximately 1370 m.

4.2.1.2 Climate

The SBSh is, in relative terms for the Prince George Region, dry and warm. It is the driest subzone in the Rocky Mountain Trench (Tables 1.1 and 4.3), being especially dry during the summer months. The primary reason for the relatively dry climate is that the subzone lies in the rainshadow of the high mountains to the west (the Premier Range).

4.2.1.3 Vegetation

Because of the extensive fire history of the subzone, the dominant trees are lodgepole pine and Douglas-fir. Although they are primarily seral species in this subzone, they do form the climax canopy on drier sites. Hybrid white spruce and subalpine fir, and, possibly Douglas-fir, are the climatic-climax tree species. Douglas-fir tends to be a component of near climax stands for some time due to its long life, but is is unknown whether it can reproduce in perpetuity under a dense canopy in the subzone. Because of the fire history in the area, hybrid white spruce and subalpine fir climax stands are rare, only occurring as pure stands on wetter sites or on cooler northeast aspects. Although fires are now being suppressed, true climax stands will continue to be rare due to intensive forest management, and consequently from a forest management perspective, Douglas-fir and lodgepole pine are definitely important components of all forest stands except the wettest sites.

Trembling aspen is often present as a seral component. Paper birch and cottonwood are also seral components of some ecosystems. Black spruce is present on poorly to very poorly drained sites. Western redcedar occurs sporadically throughout the subzone, usually on wetter, cooler sites.

The zonal plant association is characterized as a Spiraea - Pleurozium association and is dominated by Pseudotsuga menziesii, Picea glauca x engelmannii, Pinus contorta, Spiraea betulifolia, Pleurozium schreberi, Rhytidiadelphus triquetrus and Hylocomium splendens. Mesic vegetation has moderately to poorly developed shrub and herb layers and usually a well-developed moss layer.

Wetlands are common in the valley bottom, but rare elsewhere.

The ecosystem units are described in detail in Section 7.1.

4.2.1.4 Surficial Materials and Soils

Morainal and glaciofluvial deposits cover the greatest area in this subzone. Less common are colluvial, fluvial, eolian, lacustrine, and organic deposits.

Morainal deposits occur in this subzone along the east wall of the Rocky Mountain Trench and on the walls of the Fraser River valley towards Mt. Robson. These deposits are often calcareous, relatively coarse-textured, and are capped by surface-washed material. The soil developed on well and moderately well drained deposits is typically a Brunisolic Gray Luvisol, with sandy loam to sandy clay loam texture.

Glaciofluvial deposits occur over a considerable area on the floor of the Trench. They are generally sandy in texture and have between zero and seventy percent coarse fragments. On well drained sites, soils on these deposits are Orthic or Eluviated Dystric Brunisols or Orthic Humo-Ferric Podzols.

Colluvial deposits occur at higher elevations in the subzone. Their texture depends on the age and source of the colluvium. Modal soil development on well drained sites is typically an Orthic Humo-Ferric Podzol.

The only subzone where eolian deposits occur is the SBSh subzone. Hence, the discussion of eolian deposits in the introduction to the study area applies here.

Lacustrine deposits, usually having silty clay loam or silty clay texture, occur as both isolated pockets of glaciolacustrine sediments and as more extensive deposits in the valley between Tete Jaune and McBride. Fluvial deposits occur along the major rivers and creeks in the subzone. The older terraces of the Fraser River often overlie lacustrine deposits and although sandy in texture, are often moderately well to imperfectly drained because of the underlying, slowly pervious lacustrine material.

4.2.2 Moist Rocky Mountain Sub-Boreal Spruce (SBSg)

This subzone is located below the ICHk, along the Fraser and Morkill Rivers, and along Ptarmigan Creek. It may also occur in the bottom of many of the river valleys above the ICHk and below the ESSF.

The climate is likely similar to that of the ICHk. Temperature extremes, however, are probably greater and seasonal climate may be significantly different from that of the ICHk.

The SBSg is in need of further study before it can be accurately delineated and characterized.

4.2.3 Wet Rocky Mountain Sub-Boreal Spruce (SBSf)

This subzone is located below the ICHf along all the major drainages in the area, and then continues along the lower slopes and in the side valleys of the western Rocky Mountains as far north as Pine Pass. Beyond the northern limit of the ICHf subzone, the SBSf borders the ESSF zone at upper elevations. The elevation of the subzone ranges from approximately 700 to 1100 m.

It is probably the wettest of the SBS subzones, having both high seasonal precipitation and high snowpack. As discussed previously, the temperature is probably cooler than the ICHf subzone, although insufficient data for the ICHf prevent comparison.

The dominant tree species on almost all upland ecosystems are hybrid white spruce and subalpine fir. Lodgepole pine is relatively uncommon, western hemlock occurs in isolated pockets and Douglas-fir is found only on isolated rock outcrops. Black spruce and lodgepole pine occur in forested wetlands.

The zonal plant association is tentatively characterized as a Lonicera - Oplopanax association. It has well developed shrub and herb layers and usually a poorly to moderately developed moss layer.

4.3 Engelmann Spruce - Subalpine Fir Zone (ESSF)

The ESSF is the subalpine zone above either the ICH or SBS, in this area. The elevation ranges from approximately 1370 to 2200 m.

Morainal deposits occur in this subzone along the east wall of the Rocky Mountain Trench and on the walls of the Fraser River valley towards Mt. Robson. These deposits are often calcareous, relatively coarse-textured, and are capped by surface-washed material. The soil developed on well and moderately well drained deposits is typically a Brunisolic Gray Luvisol, with sandy loam to sandy clay loam texture.

Glaciofluvial deposits occur over a considerable area on the floor of the Trench. They are generally sandy in texture and have between zero and seventy percent coarse fragments. On well drained sites, soils on these deposits are Orthic or Eluviated Dystric Brunisols or Orthic Humo-Ferric Podzols.

Colluvial deposits occur at higher elevations in the subzone. Their texture depends on the age and source of the colluvium. Modal soil development on well drained sites is typically an Orthic Humo-Ferric Podzol.

The only subzone where eolian deposits occur is the SBSh subzone. Hence, the discussion of eolian deposits in the introduction to the study area applies here.

Lacustrine deposits, usually having silty clay loam or silty clay texture, occur as both isolated pockets of glaciolacustrine sediments and as more extensive deposits in the valley between Tete Jaune and McBride. Fluvial deposits occur along the major rivers and creeks in the subzone. The older terraces of the Fraser River often overlie lacustrine deposits and although sandy in texture, are often moderately well to imperfectly drained because of the underlying, slowly pervious lacustrine material.

4.2.2 Moist Rocky Mountain Sub-Boreal Spruce (SBSg)

This subzone is located below the ICHk, along the Fraser and Morkill Rivers, and along Ptarmigan Creek. It may also occur in the bottom of many of the river valleys above the ICHk and below the ESSF.

The climate is likely similar to that of the ICHk. Temperature extremes, however, are probably greater and seasonal climate may be significantly different from that of the ICHk.

The SBSg is in need of further study before it can be accurately delineated and characterized.

4.2.3 Wet Rocky Mountain Sub-Boreal Spruce (SBSf)

This subzone is located below the ICHf along all the major drainages in the area, and then continues along the lower slopes and in the side valleys of the western Rocky Mountains as far north as Pine Pass. Beyond the northern limit of the ICHf subzone, the SBSf borders the ESSF zone at upper elevations. The elevation of the subzone ranges from approximately 700 to 1100 m.

It is probably the wettest of the SBS subzones, having both high seasonal precipitation and high snowpack. As discussed previously, the temperature is probably cooler than the ICHf subzone, although insufficient data for the ICHf prevent comparison.

The dominant tree species on almost all upland ecosystems are hybrid white spruce and subalpine fir. Lodgepole pine is relatively uncommon, western hemlock occurs in isolated pockets and Douglas-fir is found only on isolated rock outcrops. Black spruce and lodgepole pine occur in forested wetlands.

The zonal plant association is tentatively characterized as a Lonicera - Oplopanax association. It has well developed shrub and herb layers and usually a poorly to moderately developed moss layer.

4.3 Engelmann Spruce - Subalpine Fir Zone (ESSF)

The ESSF is the subalpine zone above either the ICH or SBS, in this area. The elevation ranges from approximately 1370 to 2200 m.

Climatic data are minimal (Tables 1.1 and 4.4) but in general, the zone is characterized by higher precipitation, cooler temperatures, and therefore, a shorter growing season then the zones below it.

Table 4.2 differentiates the ESSF from the lower elevation zones (ICH and SBS) using vegetation characteristics. The forests of the ESSF are dominated by the climatic climax tree species Engelmann spruce and subalpine fir. At the upper elevations of this zone, where the climate becomes more severe, the forests begin to become more open, and eventually form clumped, stunted stands. This area is referred to as the parkland. Both forested and parkland subzones are recognized in the ESSF.

Six biogeoclimatic subzones have been tentatively delineated[1] in the ESSF in the study area (Table 4.1). Most ESSF subzones are in need of further study and correlation with other regions before they can be accurately delineated and characterized.

Mesic vegetation in the forested subzones is characterized by Engelmann spruce and subalpine fir; the shrubs *Menziesia ferruginea*, *Rhododendron albiflorum*, and *Vaccinium membranaceum*; the herbs *Rubus pedatus*, *Orthilia secunda*, and *Lycopodium annotinum*; and the *bryophytes* (mosses and liverworts) *Pleurozium schreberi*, *Barbilophozia lycopodioides*, *B. floerkei*, and *Ptilium crista-castrensis*. *Rhododendron albiflorum*, *Lycopodium annotinum* and *Barbilophozia lycopodioides* are more common in the northern part of the study area; *Menziesia ferruginea*, *Ribes lacustre*, *Cornus canadensis* and *Hylocomium splendens* are more common in the southern part of the area (ESSFo); and *Vaccinium ovalifolium*, *Gymnocarpium dryopteris*, *Streptopus roseus*, and *Valeriana sitchensis* are more common in the southwestern part of the area (ESSFh).

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[1] The parkland subzones of the ESSF have been mapped together with the AT on the biogeoclimatic unit maps due to the problems of accurately delineating the parkland subzones on 1:250 000 scale maps.

Mesic vegetation of tree clumps in the parkland subzones is characterized by *Abies lasiocarpa* (low mean cover); the shrub *Vaccinium membranaceum*; the herbs *Phyllodoce empetriformis*, *Cassiope mertensiana*, *Luetkea pectinata*, and *Vahlodea atropurpurea*; and the liverwort *Barbilophozia lycopodioides*. Insufficient sampling has been done to adequately charaterize the different parkland subzones based on vegetation characters.

4.4 Alpine Tundra Zone (AT)

The AT is the "treeless" zone above the ESSF parkland. The climate is severe, with high precipitation, cold temperatures, high winds, and obviously, the shortest growing season. Alpine ecosystems vary considerably due to such factors as depth and duration of snowpack, exposure to wind, elevation, soil moisture and nutrients, aspect, slope stability, parent material, bedrock and geomorphic processes. Section 3.5.4 discusses general features of alpine vegetation in this area.

Subzones have not been delineated for the AT zone in this area. The AT usually lies above 1900-2000 m, although the elevation varies with aspect and exposure. Further study is required in this zone.

5.0 USE OF THE MANUAL

5.1 Introduction and Definitions

This manual should allow the user to identify any forested ecosystem within the study area. To do this, the format and descriptions within the manual must be understood. The description of each ecosystem association consists of three sections: a general description section; a vegetation section; and a soil and site section. Ecosystem subassociations and phases are often described in less detail. While most of the information is self-explanatory, some of the terms and symbols will require further clarification.

5.1.1 Subzone Map

The subzone maps that accompany the manual delineate the particular subzone boundaries at a scale of 1:250 000. It must be emphasized that these are not ecosystem maps, i.e., they do not indicate the location of the ecosystems within any particular subzone.

5.1.2 Toposequence Diagram

These is a schematic toposequence presented for each subzone showing the relative distribution of ecosystem units on the landscape within a hypothetical catchment area. They are, of necessity, generalized, but attempt to show the slope position and parent materials where the ecosystem associations commonly occur. A key to tree species and parent materials for these diagrams is given in Appendix 10.1.

5.1.3 General Description Section

Ecosystem unit: the ecosystem association, subassociation or phase. It consists of three parts: a code name, a scientific name, and a common name.

The first ecosystem unit within a particular subzone (the 01) is the mesic or zonal association. Other associations are then numbered from dry to wet and secondly, poor to rich. A "slash" separates the biogeoclimatic from the ecosystem units. Subassociations are designated numerically and phases alphabetically, e.g. SBSh/01.1 is the zonal SBSh association, thimbleberry subassociation. ICHk/01(a) is the zonal ICHk association, medium- to coarse-textured phase.

The scientific names for the ecosystem association or subassociation are derived from the dominant and/or characteristic plant species occurring in maturing seral to climax vegetation. Only genera are used unless confusion would occur. When the species name is given, it is in parentheses. Two names are used for associations, three for subassociations. Common names are also given for each association.

Site Diagram: is a schematic representation of the particular unit. They attempt to present a visual image of that unit, showing stand structure, relief, and soil texture. A key to tree species and soil textures is given in Appendix 10.1. The scale bar beside each diagram represents 25 m in height.

Ecological Moisture Regime: signifies on a relative scale, for that particular subzone, the available moisture supply for plant growth. Assessment of moisture regime is based on several factors which are illustrated in Appendix 10.2. The dominant moisture regime(s) is(are) stated for each ecosystem unit. Those in brackets occur less commonly. A more detailed discussion of moisture regime is presented in Walmsley et al. (1980).

Ecological Nutrient Regime: signifies on a relative scale, for that particular subzone, the available nutrient supply for plant growth. Assessment of nutrient regime is based on several factors, illustrated in Appendix 10.3. This table is based on the discussion of Walmsley et al. (1980), although their table has been considerably modified in this publication. The dominant nutrient regime(s) is(are) stated for each ecosystem unit. Those in brackets occur less commonly.

Edatopic Grid: represents schematically the range of moisture and nutrient regimes occupied by the ecosystem units within a particular subzone. The axes (1-7) and (A-E) represent moisture and nutrient regimes, respectively. The area covered by an ecosystem unit on the edatopic grid represents, on a relative scale, the areal extent of that unit within the subzone. Enlarged edatopic grids for each subzone, with axes properly labelled, are presented in Figs.6.1, 6.3, 6.5, 6.7, and 7.1.

Important Environmental Features: are important soil and site factors that aid in distinguishing the ecosystem unit. The features are common to that unit, but are not necessarily diagnostic; i.e., the same feature may occur on another unit. Terms used are fully described in the soils and site section in Walmsley et al.(1980).

Distribution: indicates in general terms the frequency of occurrence of the ecosystem unit throughout the subzone, although it does not necessarily indicate areal extent of the unit. Terms used are rare, uncommon, common, and very common.

5.1.4 Vegetation Page

This lists the important or characteristic plant species of the ecosystem unit, and may have comments on certain of the species. Characteristic species are those found most frequently in maturing seral to climax stands. Indicator species are listed by their scientific name, followed by a common name (if one exists). Scientific names of vascular plants follow that of Taylor and MacBryde (1977). Moss nomenclature follows Crum *et al*.(1973); lichens follow Hale and Culberson (1970); liverworts follow Stotler and Crandall-Stotler (1977). Appendix 10.4 lists both scientific and common names of all the plants appearing in this guide.

The vegetation is listed by four layers which are defined as follows:

Tree Layer: contains woody plants greater than 10 m in height. Species that are seral in the ecosystem unit are noted.

Shrub Layer: contains woody plants less than 10 m in height and generally greater than 20 cm in height. It includes tree regeneration, which is always listed first, irrespective of its abundance.

Herb Layer: contains herbaceous plants (grasses and forbs) regardless of height, and some woody plants less than approximately 20 cm tall (for a list of low woody plants considered in the herb layer, see Walmsley *et al*. (1980)).

Moss Layer: contains mosses, lichens, and liverworts growing on the forest floor.

For each layer species are generally listed in order of importance, i.e. those listed first occur most commonly (highest percent constancy) and with the highest cover for that particular ecosystem unit. Species that are bracketed [ ] are less important, i.e. they occur with less constancy and/or with low coverage.

Comments for certain species include the indicator value, relative cover, and an indication of dominance. A good indicator usually only occurs in that ecosystem unit (i.e. it has quite specific growth requirements). The cover of a particular plant species refers to the percentage of the ground surface occupied by a vertical projection of the crown of that species. Low cover generally implies less than 5% coverage and high cover implies greater than 30% coverage. Comments on the % cover are only included for those species whose cover is important in distinguishing associations. If any particular species dominates a particular layer, it is also noted. A total cover is also given for each layer (tree, shrub, herb, and moss).

The abbreviation "sp." after the name of a plant genus refers to a single, unknown species, while "spp." refers to several species belonging to the same genus (e.g. Cladina spp.). The abbreviation "ssp." refers to a subspecies of a particular species (e.g. Alnus incana ssp. tenuifolia). An "x" between two species names indicates a hybrid, e.g. Picea glauca x engelmannii.

5.1.5 Soil and Site Section

This summarizes any environmental data for the particular ecosystem unit which has not previously been detailed in the section on Important Environmental Features. Numerical values given for any particular feature are average values from sample plots; ranges are given in brackets ( ). Some terms may need more detailed explanation and are discussed below.

Parent Material, Soil and Humus Form: are classified according to classification systems already developed. These classifications are for parent material (British Columbia Environment and Land Use Committee Secretariat 1978); soil (Canada Soil Survey Committee 1978); and humus form (Klinka et al. 1981). Soils are usually classified to the great group level (occasionally order or subgroup level) and humus forms to the group level (occasionally only order level).

Coarse Fragments (%):	the percentage by volume of gravels, cobbles and stones coarser than 2 mm.
Soil Drainage:	the rate at which water is removed from the soil in relation to the addition of water. For classes, see Walmsley *et al*. (1980). The word "drained" is implied in each class.
Rooting Depth:	the depth to which the majority of roots extend into the soil (does not include rooting depth in the humus horizons).
Humus Thickness:	the thickness of the surface organic horizons. It does not include the thickness of the litter layer if is it intermixed with the living moss layer, or that of Ah horizons. For organic soils, only a lower limit is given.
pH Humus:	pH (in water) of a composite humus sample.
pH Mineral:	pH (in $CaCl_2$) of the mineral soil to rooting depth.
Slope Position:	describes the relative position of the site within a catchment area (see Figure 5.1). It refers to meso slope position as outlined in Walmsley *et al*. (1980).
Soil Texture:	refers to the soil texture of the mineral soil within the rooting zone. The 13 soil texture classes (the relative percentage of sand, silt, and clay) have been combined into five general classes as outlined in Figure 5.2.

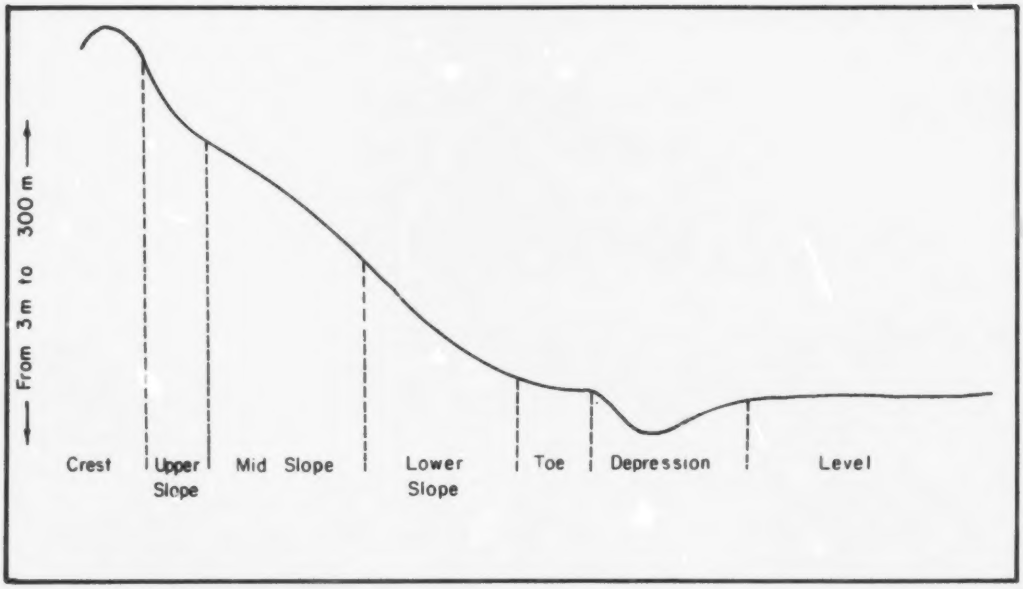

From 3m to 300 m
Crest
Upper Slope
Mid Slope
Lower Slope
Toe
Depression
Level

FIG. 5.1. Meso slope position

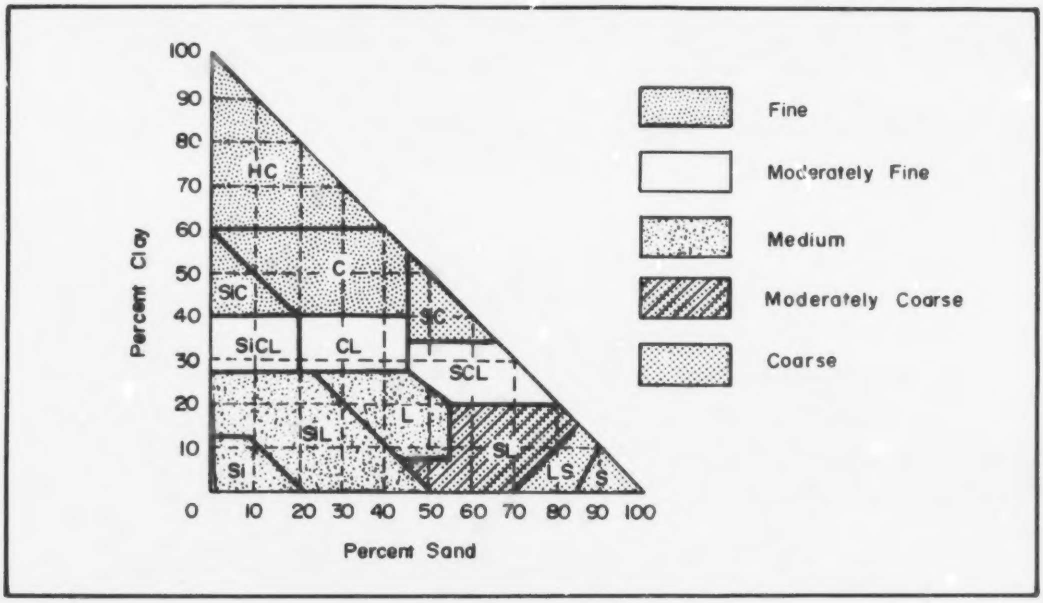

100
90
80
70
60
50
40
30
20
10
0
Percent Clay
HC
C
SiC
SiCL
CL
SC
SCL
L
SiL
Si
SL
LS
S
10
20
30
40
50
60
70
80
90
100
Percent Sand
Fine
Moderately Fine
Medium
Moderately Coarse
Coarse

FIG. 5.2. Soil textural triangle

5.2 Procedure for Using the Guide

This Section outlines the procedure for classifying a particular forested site with the aid of this guide.

5.2.1 Identifying Subzones

The users of the subzone map will be able to place any forested site whose location is known, within a subzone. In areas that are close to, or on, subzone boundaries, there may be difficulties in identifying the subzone. In these cases, the user should attempt to identify the ecosystem for both subzones and see which appears to be most correct.

5.2.2 Identifying Ecosystem Units

Once the subzone has been identified, the user must identify the particular ecosystem unit. This is done by using a combination of soil and site factors plus identification of the plant species growing on the site. The outline given here includes brief "how to identify" guidelines for soil and site factors. Publications that aid in identifying plant species are given in Appendix 10.5.

The first step is to identify the moisture and nutrient regimes of the stand using site and soil factors. The major factors to consider are:

slope position
slope gradient and aspect
depth to water table
soil texture and coarse fragments
humus form and depth

The synthesis of these factors, in conjunction with the tables in Appendices 10.2 and 10.3, will enable the user to place the site on the edatopic grid. That position should correspond to one or possibly two ecosystem units.

The next step is to identify the vegetation on the site. The species list given for each vegetation unit was determined from mature seral to climax vegetation (greater than 80 years). For stands less than 80 years old, plant indicators should be treated carefully and only if the user has considerable experience with vegetation/environmental relationships. Identify as many shrubs, herbs, and mosses growing on the site as is possible, noting their cover and relative abundance. This vegetation list, along with any other accessory soil information that is collected, can be compared with that given in the guide for the one (or two) ecosystem units that occur on the grid position previously located. The specific ecosystem unit can then be identified. If the particular ecosystem association or subassociation is further subdivided into ecosystem phases, then the soil information that has been collected will enable identification of the ecosystem phase.

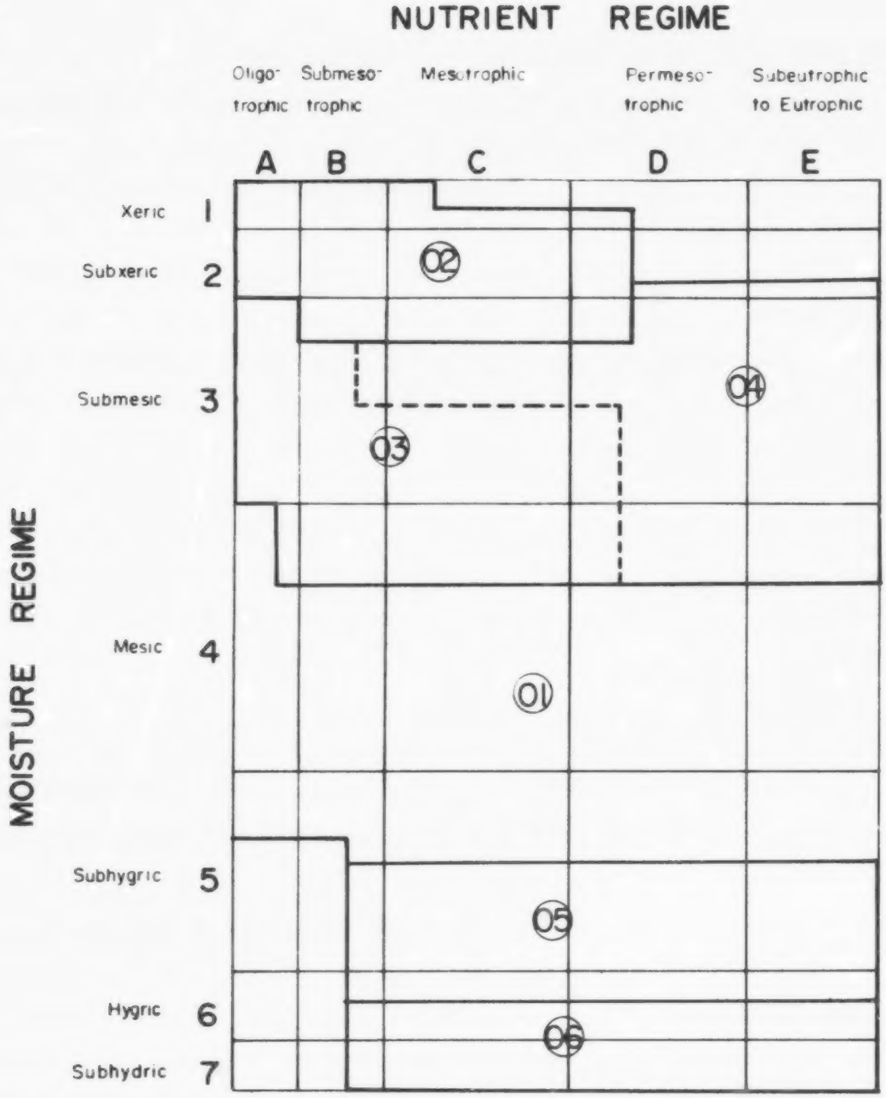
Once a particular unit has been identified, the user may then turn to the interpretations section of the guide where, for all ecosystem units, guidelines have been given for selected management activities.

6.0 ECOSYSTEM UNITS OF THE INTERIOR CEDAR - HEMLOCK ZONE

6.1 Ecosystem Units of the ICHb

TABLE 6.1. Ecosystem (biogeocoenotic) units of the Wet Interior Cedar - Hemlock subzone (ICHb)

	Ecosystem association	
Code	Scientific name	Common name
ICHb/01	Rubus - Athyrium	Thimbleberry - lady fern
ICHb/02	Paxistima - Chimaphila	Falsebox - prince's pine
ICHb/03	Lonicera - Aralia	Red twinberry - wild sarsaparilla
ICHb/04	Vaccinium (membranaceum) - Dryopteris	Black huckleberry - spiny wood fern
ICHb/05	Cornus - Equisetum (arvense)	Red-osier dogwood - common horsetail
ICHb/06	Lysichiton - Mnium	Skunk cabbage - leafy moss


NUTRIENT REGIME
Oligotrophic
Submesotrophic
Mesotrophic
Permesotrophic
Subeutrophic to Eutrophic
A
B
C
D
E
MOISTURE REGIME
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02
04
03
01
05
06

ICHb Associations

- 01 Thimbleberry–Lady Fern
- 02 False Box – Prince's Pine
- 03 Red Twinberry–Wild Sarsaparilla
- 04 Black Huckleberry–Spiny Wood Fern
- 05 Red-Osier Dogwood–Common Horsetail
- 06 Skunk Cabbage - Leafy Moss

FIG. 6.1 Edatopic grid of ecological moisture and nutrient regime for the ICHb subzone.

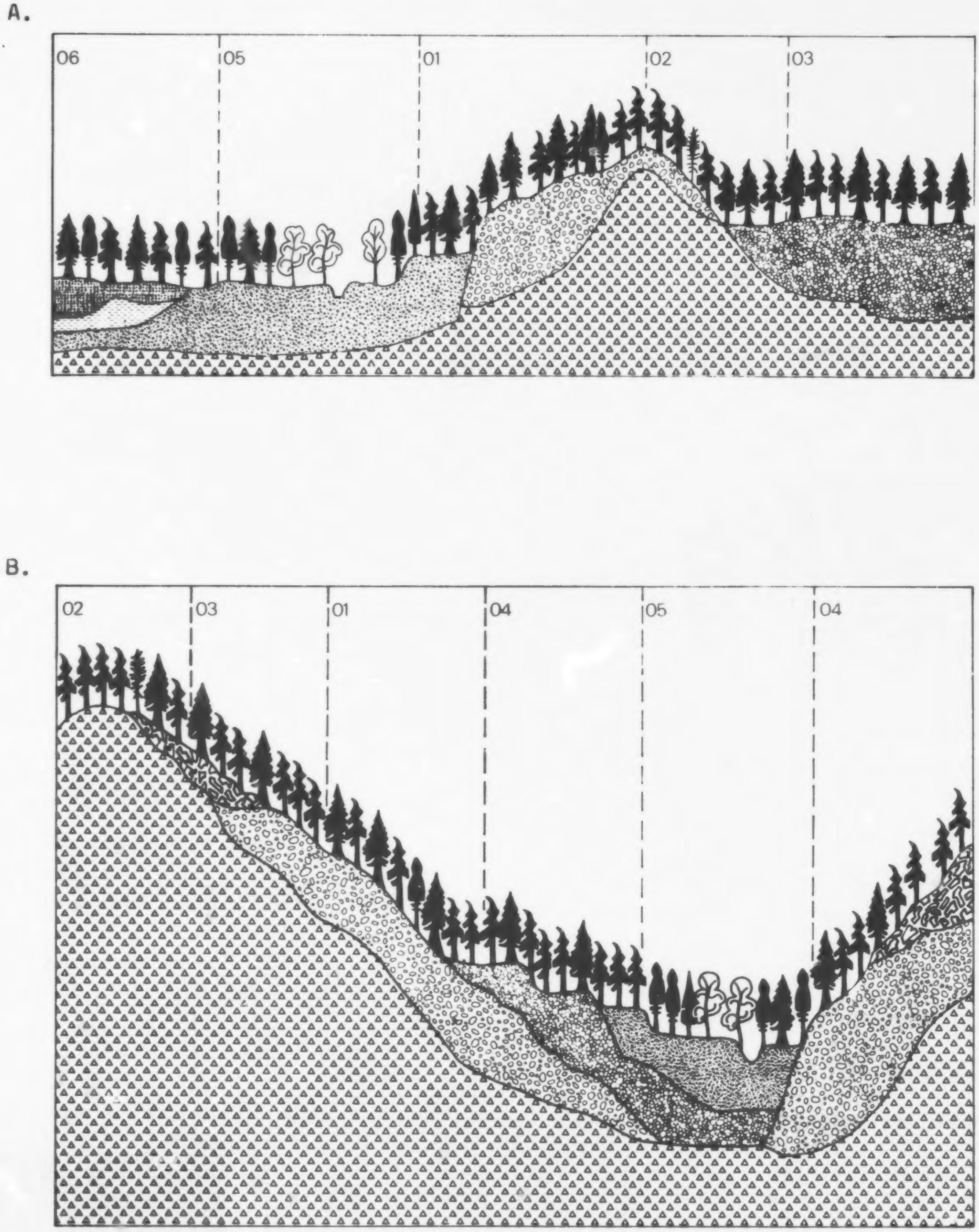
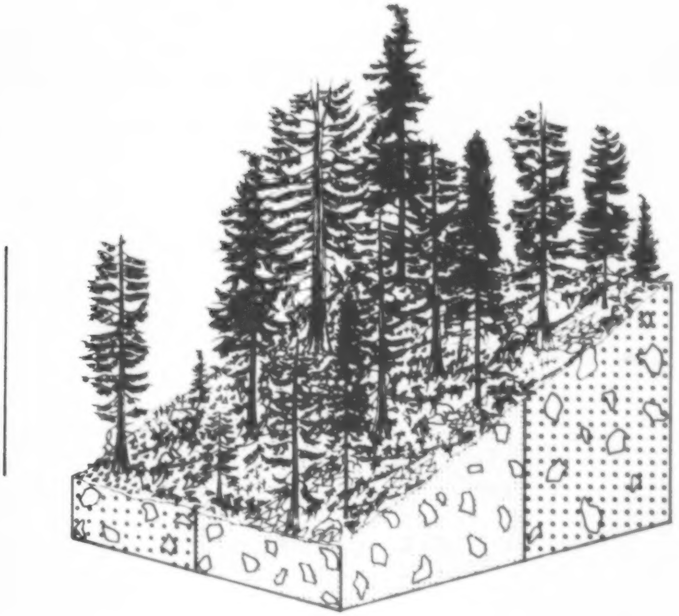

A.
06
05
01
02
03
B.
02
03
01
04
05
04

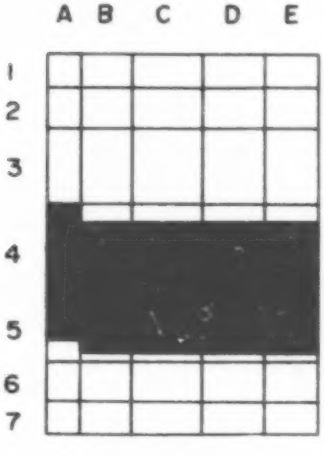
FIG. 6.2 Toposequence of associations in the ICHb subzone.
A: Subdued topography; B: Steep slopes.

ICHb/01 THIMBLEBERRY - LADY FERN

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/01; *Rubus* - *Athyrium*; ICHb: Thimbleberry - lady fern association.





ECOLOGICAL MOISTURE REGIME: mesic - subhygric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - eutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: mid - lower
Slope Gradient: 24 (0-55, commonly less than 40)

DISTRIBUTION: very common

ICHb/01 THIMBLEBERRY - LADY FERN

VEGETATION:

Tree Layer: 40% cover

Thuja plicata	(western redcedar)	
Tsuga heterophylla	(western hemlock)	
Picea glauca x *engelmannii*	(hybrid white spruce)	
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 45% cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Oplopanax horridus	(devil's club)	- high cover
Rubus parviflorus	(thimbleberry)	)- low cover
Vaccinium ovalifolium	(oval-leaved blueberry)	)
[*Ribes lacustre*	(black gooseberry)]	

Herb Layer: 65% cover

Athyrium filix-femina	(lady fern)	) - dominants
Gymnocarpium dryopteris	(oak fern)	)
Tiarella unifoliata	(one-leaved foamflower)	
Streptopus roseus	(rosy twistedstalk)	
Dryopteris assimilis	(spiny wood fern)	
Galium triflorum	(sweet-scented bedstraw)	
Clintonia uniflora	(queen's cup)	
Circaea alpina	(enchanter's nightshade)	
[*Cornus canadensis*	(bunchberry)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	
[*Viola canadensis*	(Canada violet)]	
[*Rubus pedatus*	(five-leaved bramble)]	

Moss Layer: 20% cover

Mnium spp.	(leafy mosses)	- dominant
[*Brachythecium* spp.]		

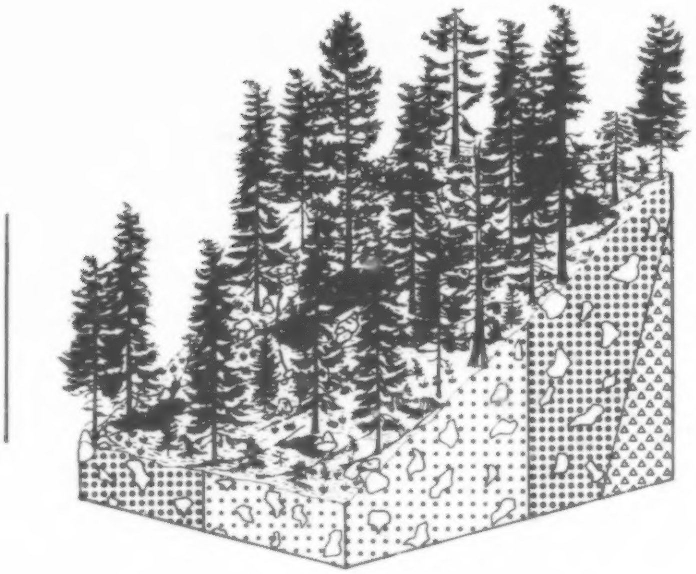
SOIL AND SITE:

Parent Material: fluvial, colluvial, and morainal
Soil Classification: commonly Humo-Ferric Podzol or Ferro-Humic Podzol; also Dystric and Melanic Brunisol
Soil Texture: medium, moderately coarse, and coarse
Coarse Fragments (%): 40 (0-80, usually greater than 20)
Soil Drainage: well - moderately well
Rooting Depth (cm): 43 (0-110)
Seepage Water: very rarely present
Humus Thickness (cm): 8 (2-38, usually less than 12)
pH Mineral: 4.9 (4.1-6.3)

ICHb/02 FALSEBOX - PRINCE'S PINE

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/02; Paxistima - Chimaphila; ICHb: Falsebox - prince's pine association.



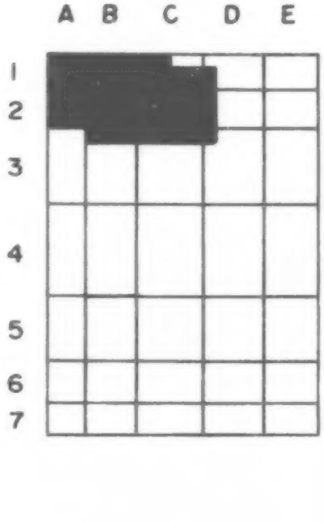
ECOLOGICAL MOISTURE REGIME: xeric - subxeric (- submesic)

ECOLOGICAL NUTRIENT REGIME: oligotrophic - mesotrophic (- permesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: upper - crest
Soil Texture: moderately coarse - coarse
Coarse Fragments (%): 42 (0-80, usually greater than 30)

DISTRIBUTION: uncommon



ICHb/02 FALSEBOX - PRINCE'S PINE

VEGETATION:

Tree Layer: 55% cover

Tsuga heterophylla	(western hemlock)	- dominant
Thuja plicata	(western redcedar)	- low cover
[*Pseudotsuga menziesii*	(Douglas-fir)]	- seral
[*Pinus monticola*	(western white pine)]	- seral, low cover

Shrub Layer: 30% cover; moderate cover of regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Paxistima myrsinites	(falsebox)	- good indicator
Vaccinium membranaceum	(black huckleberry)	
[*Vaccinium ovalifolium*	(oval-leaved blueberry)]	
[*Lonicera utahensis*	(red twinberry)]	- low cover
[*Taxus brevifolia*	(western yew)]	

Herb Layer: 10% cover

Clintonia uniflora	(queen's cup)
Cornus canadensis	(bunchberry)
Chimaphila umbellata	(prince's pine)
[*Orthilia secunda*	(one-sided wintergreen)]
[*Goodyera oblongifolia*	(rattlesnake-plantain)]
[*Tiarella unifoliata*	(one-leaved foamflower)]
[*Linnaea borealis*	(twinflower)]

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feather moss)
Hylocomium splendens	(step moss)
Rhytidiopsis robusta	(pipecleaner moss)

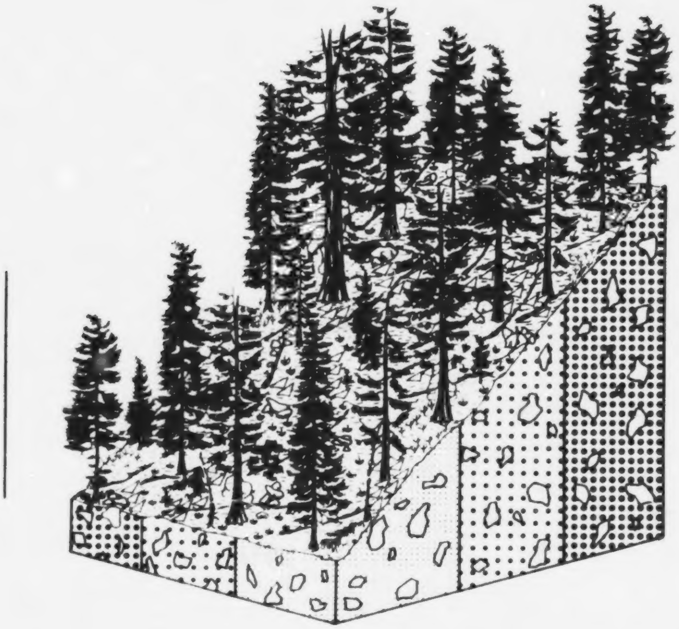
SOIL AND SITE:

Slope Gradient (%): 30 (0-72)
Parent Material: variable
Soil Classification: usually Orthic Humo-Ferric Podzol; occasionally Dystric Brunisol or Luvisol
Soil Drainage: rapidly - well
Rooting Depth (cm): 52 (20-100)
Humus Thickness (cm): 5 (2-16, usually less than 7)
pH Mineral: 4.9 (4.1-5.4)

ICHb/03 RED TWINBERRY - WILD SARSAPARILLA

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/03; Lonicera - Aralia; ICHb: Red twinberry - wild sarsaparilla association.



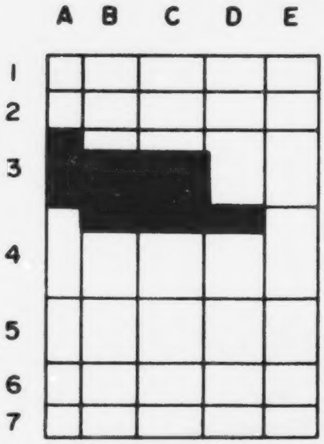
ECOLOGICAL MOISTURE REGIME: submesic - mesic

ECOLOGICAL NUTRIENT REGIME: (oligotrophic -) submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: mid - upper, or coarse-textured level

DISTRIBUTION: common



ICHb/03 RED TWINBERRY - WILD SARSAPARILLA

VEGETATION:

Tree Layer: 45% cover

Tsuga heterophylla	(western hemlock)	
Thuja plicata	(western redcedar)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	- low cover
[*Pseudotsuga menziesii*	(Douglas-fir)]	- low cover, seral

Shrub Layer: 25% cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Vaccinium ovalifolium	(oval-leaved blueberry)	
Vaccinium membranaceum	(black huckleberry)	
Lonicera utahensis	(red twinberry)	
Taxus brevifolia	(western yew)	
Paxistima myrsinites	(falsebox)	- good indicator
Menziesia ferruginea	(false azalea)	
[*Oplopanax horridus*	(devil's club)]	- low cover
[*Acer glabrum*	(Douglas maple)]	

Herb Layer: 45% cover

Cornus canadensis	(bunchberry)	
Gymnocarpium dryopteris	(oak fern)	- variable cover
Clintonia uniflora	(queen's cup)	
Tiarella unifoliata	(one-leaved foamflower)	
Aralia nudicaulis	(wild sarsaparilla)	- good indicator
Streptopus roseus	(rosy twistedstalk)	
Dryopteris assimilis	(spiny wood fern)	
Disporum hookeri	(Hooker's fairybells)	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Viola orbiculata*	(round-leaved violet)]	

Moss Layer: 45% cover

Rhytidiopsis robusta	(pipecleaner moss)
Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
[*Hylocomium splendens*	(step moss)]

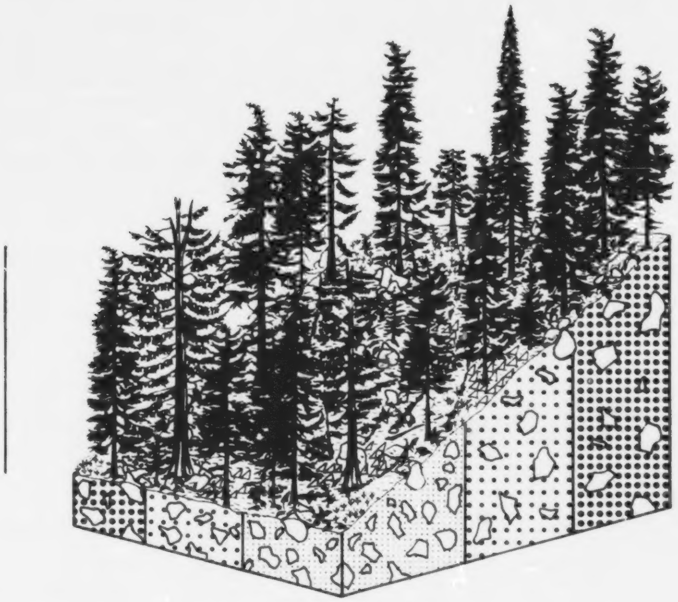
SOIL AND SITE:

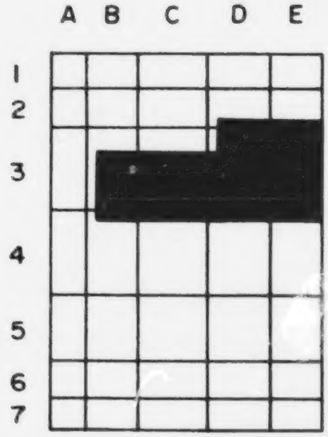
Slope Gradient (%): 34 (0-70, usually greater than 20)
Parent Material: variable
Soil Classification: commonly Humo-Ferric Podzol; also Podzolic Gray Luvisol, Ferro-Humic Podzol, and Brunisol
Soil Texture: medium, moderately coarse, and coarse
Coarse Fragments (%): 45 (0-90, usually greater than 25)
Soil Drainage: well (- moderately well)
Rooting Depth (cm): 53 (17-120)
Humus Thickness (cm): 6 (0-24, usually less than 8)
pH Mineral: 5.0 (3.4-7.4)

ICHb/04 BLACK HUCKLEBERRY - SPINY WOOD FERN

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/04; *Vaccinium* (*membranaceum*) - *Dryopteris assimilis*; ICHb: Black huckleberry - spiny wood fern association.





ECOLOGICAL MOISTURE REGIME: subxeric - mesic

ECOLOGICAL NUTRIENT REGIME: oligotrophic - mestrophic (- subeutrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: mid - upper, or coarse-textured level

Soil Texture: medium - moderately coarse with greater than 30% coarse fragments; or coarse

DISTRIBUTION: uncommon

ICHb/04 BLACK HUCKLEBERRY - SPINY WOOD FERN

VEGETATION:

Tree Layer: 50% cover

Tsuga heterophylla	(western hemlock)	
Thuja plicata	(western redcedar)	
[Picea glauca x engelmannii	(hybrid white spruce)]	)- low cover
[Abies lasiocarpa	(subalpine fir)]	)

Shrub Layer: 20% cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Vaccinium ovalifolium	(oval-leaved blueberry)	
Vaccinium membranaceum	(black huckleberry)	
[Oplopanax horridus	(devil's club)]	- low cover
[Lonicera utahensis	(red twinberry)]	
[Taxus brevifolia	(western yew)]	
[Menziesia ferruginea	(false azalea)]	

Herb Layer: 40% cover

Dryopteris assimilis	(spiny wood fern)	- low to mod. cover
Gymnocarpium dryopteris	(oak fern)	
Tiarella unifoliata	(one-leaved foamflower)	
Clintonia uniflora	(queen's cup)	
Rubus pedatus	(five-leaved bramble)	
Cornus canadensis	(bunchberry)	
Streptopus roseus	(rosy twistedstalk)	
[Orthilia secunda	(one-sided wintergreen)]	
[Streptopus streptopoides	(small twistedstalk)]	
[Goodyera oblongifolia	(rattlesnake-plantain)]	

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feather moss)	
Rhytidiopsis robusta	(pipecleaner moss)	
[Ptilium crista-castrensis	(knight's plume)]	
[Hylocomium splendens	(step moss)]	- occasionally present with high cover
[Dicranum fuscescens	(curly heron's-bill moss)]	
[Barbilophozia lycopodioides	(common leafy liverwort)]	

ICHb/04 BLACK HUCKLEBERRY - SPINY WOOD FERN

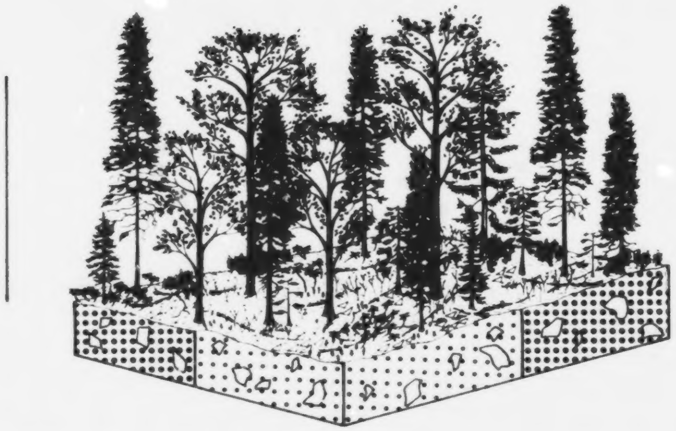
SOIL AND SITE:

Slope Gradient (%):	27 (0-70)
Parent Material:	variable
Soil Classification:	usually Orthic Humo-Ferric Podzol; also Ferro-Humic Podzol and Gray Luvisol
Coarse Fragments (%):	49 (0-80, usually greater than 30)
Soil Drainage:	well (- moderately well)
Rooting Depth (cm):	28 (3-70)
Humus Thickness (cm):	7 (3-20)
pH Mineral:	4.3 (3.2-7.1)

ICHb/05 RED-OSIER DOGWOOD - COMMON HORSETAIL

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/05; *Cornus* - *Equisetum* (*arvense*); ICHb: Red-osier dogwood - common horsetail association.



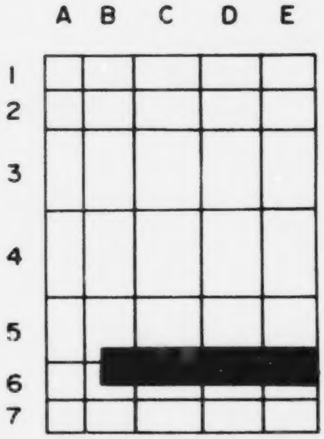
ECOLOGICAL MOISTURE REGIME: subhygric - hygric

ECOLOGICAL NUTRIENT REGIME: mesotrophic - eutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 2 (0-18, usually 0)
Parent Material: fluvial
Seepage Water: may be present at depth

DISTRIBUTION: uncommon



ICHb/05 RED-OSIER DOGWOOD - COMMON HORSETAIL

VEGETATION:

Tree Layer: 40% cover

Picea glauca x *engelmannii*	(hybrid white spruce)	
Thuja plicata	(western redcedar)	
Populus balsamifera ssp. *trichocarpa*	(black cottonwood)	

Shrub Layer: 55% cover

Thuja plicata		)- regeneration
Picea glauca x *engelmannii*		)
[*Tsuga heterophylla*]		)
Cornus sericea	(red-osier dogwood)	- mod. cover
Oplopanax horridus	(devil's club)	)- variable cover
Rubus parviflorus	(thimbleberry)	)
Lonicera involucrata	(black twinberry)	)
Vaccinium ovalifolium	(oval-leaved blueberry)	
[*Viburnum edule*	(highbush-cranberry)]	)- variable cover
[*Ribes lacustre*	(black gooseberry)]	)
[*Vaccinium membranaceum*	(black huckleberry)]	)

Herb Layer: 50% cover

Equisetum arvense	(common horsetail)	- variable cover
Gymnocarpium dryopteris	(oak fern)	
Galium triflorum	(sweet-scented bedstraw)	
Tiarella unifoliata	(one-leaved foamflower)	
Streptopus roseus	(rosy twistedstalk)	
Pyrola asarifolia	(pink wintergreen)	
Athyrium filix-femina	(lady fern)	
Dryopteris assimilis	(spiny wood fern)	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	
[*Equisetum pratense*	(meadow horsetail)]	- occasionally present with low to mod. cover

Moss Layer: 35% cover

Mnium spp.	(leafy mosses)
Rhytidiadelphus squarrosus	(bent-leaf moss)
Brachythecium spp.	

ICHb/05 RED-OSIER DOGWOOD - COMMON HORSETAIL

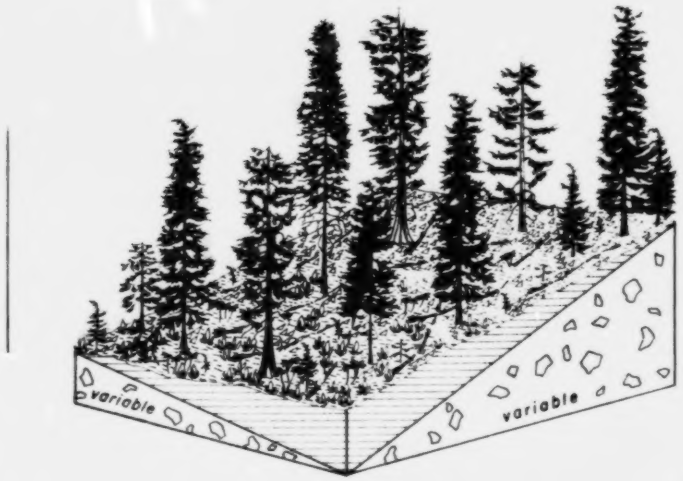
SOIL AND SITE:

Soil Classification:	gleyed subgroups and Gleysol
Soil Texture:	commonly coarse and moderately coarse, also medium
Coarse Fragments (%):	15 (0-37)
Soil Drainage:	moderately well - imperfectly
Rooting Depth (cm):	36 (5-90)
Humus Thickness (cm):	7.0 (5-13)
pH Mineral:	6.6 (5.6-8.0)

ICHb/06 SKUNK CABBAGE - LEAFY MOSS

BIOGEOCLIMATIC UNIT: ICHb

ECOSYSTEM UNIT: ICHb/06; *Lysichiton* - *Mnium*; ICHb: Skunk cabbage - leafy moss association.



ECOLOGICAL MOISTURE REGIME: hygric - subhydric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: toe, depression, or level
Seepage Water: always present

DISTRIBUTION: uncommon

	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7		■	■	■	■

ICHb/06 SKUNK CABBAGE - LEAFY MOSS

VEGETATION:

Tree Layer: 30% cover

Tsuga heterophylla	(western hemlock)
Thuja plicata	(western redcedar)
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]

Shrub Layer: 20% cover; mostly regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Oplopanax horridus	(devil's club)	)- low cover
Vaccinium ovalifolium	(oval-leaved blueberry)	)
Menziesia ferruginea	(false azalea)	)
[*Alnus incana* ssp. *tenuifolia*	(mountain alder)]	- occasionally present with low - mod. cover

Herb Layer: 80% cover

Lysichiton americanum	(skunk cabbage)	- mod. - high cover; good indicator
Athyrium filix-femina	(lady fern)	- mod. - high cover
Cornus canadensis	(bunchberry)	
Gymnocarpium dryopteris	(oak fern)	
Tiarella unifoliata	(one-leaved foamflower)	
Equisetum sylvaticum	(wood horsetail)	
[*Lycopodium annotinum*	(stiff club-moss)]	
[*Rubus pedatus*	(five-leaved bramble)]	
[*Clintonia uniflora*	(queen's cup)]	
[*Galium triflorum*	(sweet-scented bedstraw)]	

Moss Layer: 80% cover

Mnium punctatum var. *elatum*	(leafy moss)
Sphagnum squarrosum	
Pleurozium schreberi	(red-stemmed feather moss)
Pellia spp.	
[*Mnium* spp.	(leafy mosses)]

SOIL AND SITE:

Slope Gradient (%): 15 (0-22)
Parent Material: often organic; when not organic, variable
Soil Classification: Gleysol and Organic; rarely Humic Podzol
Soil Texture: variable
Coarse Fragments (%): 15 (0-45)
Soil Drainage: poorly - very poorly
Rooting Depth (cm): 32 (0-90)
Humus Thickness (cm): variable, usually greater than 20
pH Mineral: 4.8 (4.4-6.0)

6.1.1. Discussion

Within the ICHb subzone, six associations have been recognized and described. The ranges of moisture and nutrient regimes occupied by these associations are represented in Figure 6.1.

The generalized position of each association within a catchment area is represented by Figure 6.2. These diagrams are not absolute for every catchment area. They do, however, give the user the idea that associations do occupy certain specified portions of the landscape. For example, the ICHb/06 association would not be found on steep, rocky slopes, but would occur in receiving positions, usually underlain by lacustrine material. The distribution of associations and parent materials in the Rocky Mountain Trench differs between steep slopes and subdued topography. Steep slopes are much more common in the ICHb within the Prince George Region.

The distribution of each association is briefly described in the general description section. The most common association in the subzone is the ICHb/01, the zonal association. Within the Region, this association occupies greater than 50% of the subzone and the units are usually large in area. The other associations are scattered throughout the area, their occurrence depending on topography and parent material.

6.2 Ecosystem Units of the ICHj

TABLE 6.2 Ecosystem (biogeocoenotic) units of the Moist Northern Interior Cedar - Hemlock subzone (ICHj)

	Ecosystem association	
Code	Scientific name	Common name
ICHj/01	*Menziesia* - *Clintonia*	False azalea - queen's cup
ICHj/02	*Pseudotsuga* - *Paxistima*	Douglas-fir - falsebox
ICHj/03	*Tsuga* - *Pleurozium*	Hemlock - moss
ICHj/04	*Gymnocarpium* - *Hylocomium*	Oak fern - step moss
ICHj/05	*Oplopanax* - *Gymnocarpium*	Devil's club - oak fern
ICHj/06	*Oplopanax* - *Equisetum*	Devil's club - horsetail
ICHj/07	*Picea* (*mariana*) - *Sphagnum*	Black spruce - sphagnum
ICHj/08	*Lysichiton* - *Sphagnum*	Skunk cabbage - sphagnum

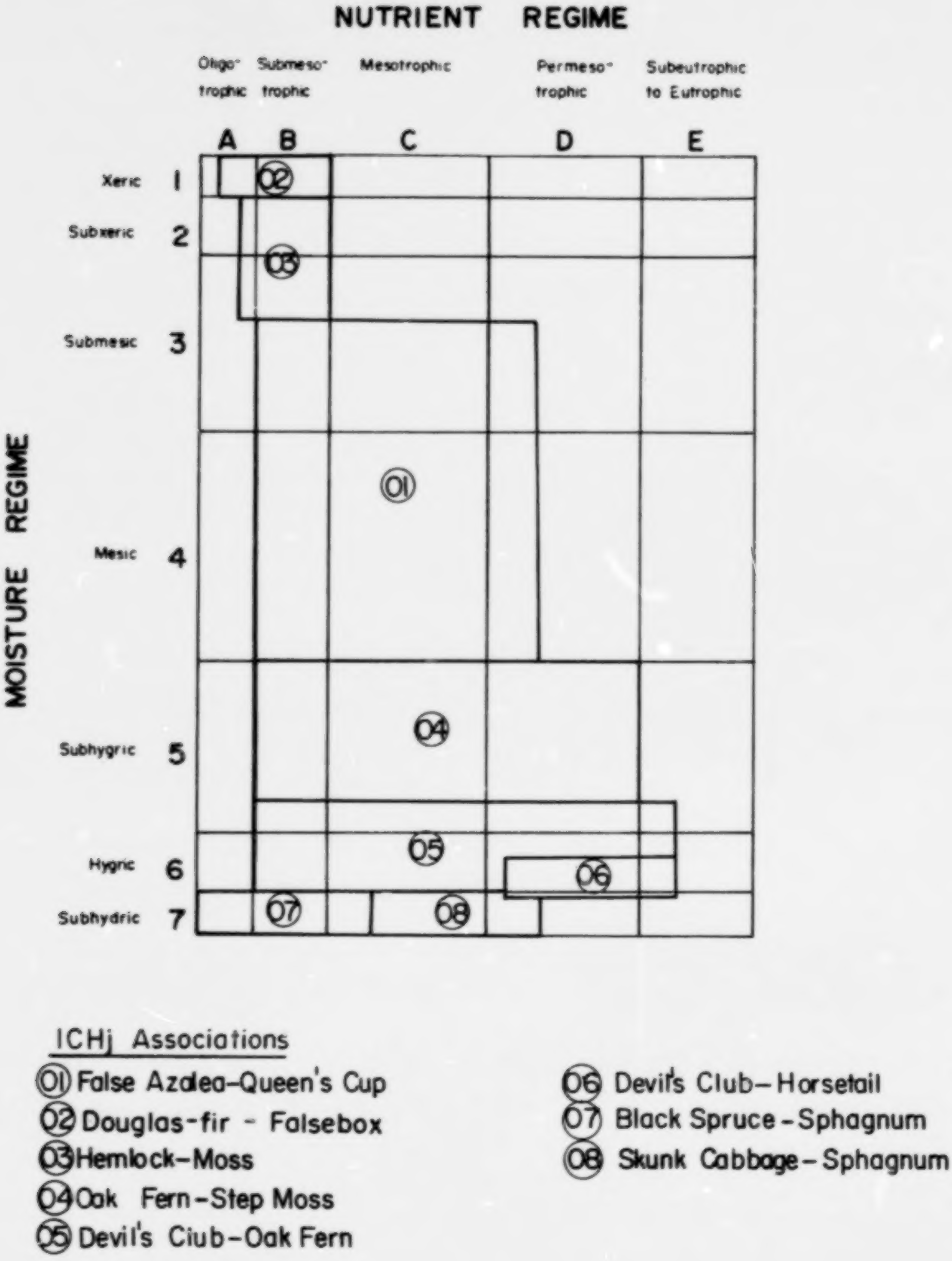

NUTRIENT REGIME
Oligo- trophic
Submeso- trophic
Mesotrophic
Permeso- trophic
Subeutrophic to Eutrophic
A
B
C
D
E
MOISTURE REGIME
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02
03
01
04
05
06
07
08
ICHj Associations
01 False Azalea-Queen's Cup
02 Douglas-fir - Falsebox
03 Hemlock-Moss
04 Oak Fern-Step Moss
05 Devil's Club-Oak Fern
06 Devil's Club-Horsetail
07 Black Spruce-Sphagnum
08 Skunk Cabbage-Sphagnum

FIG. 6.3 Edatopic grid of ecological moisture and nutrient regime for the ICHj subzone.

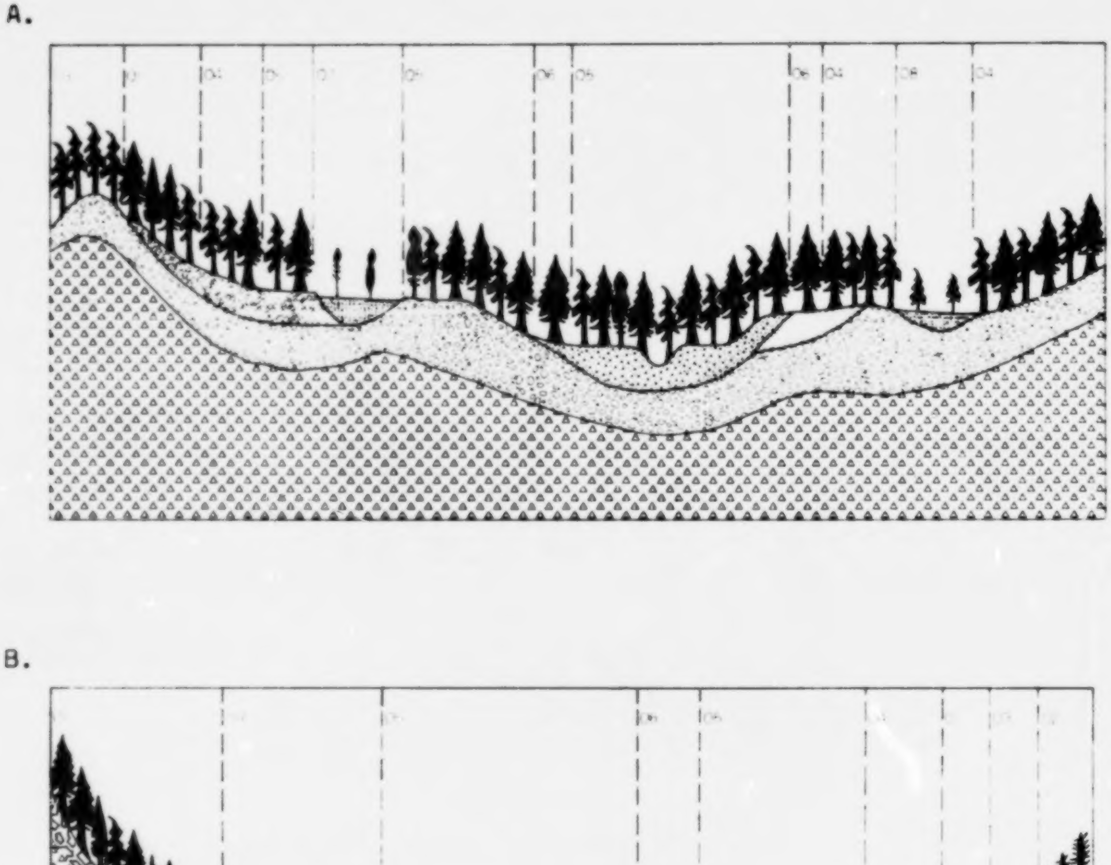

A.
04
06
05
06
04
08
04
B.
06
05

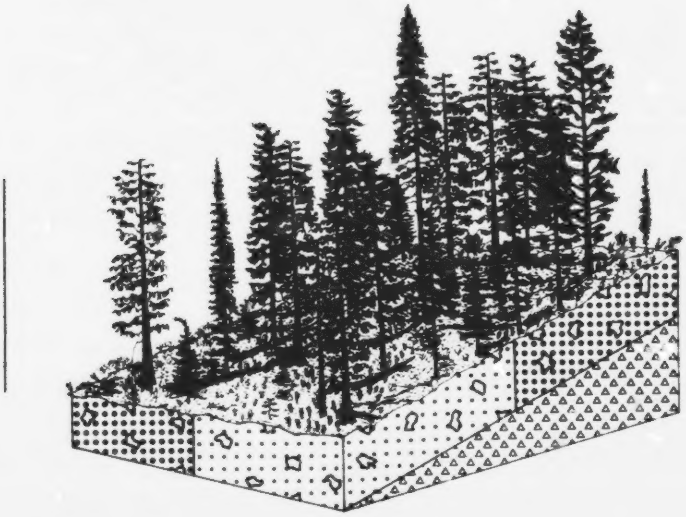
FIG. 6.4. Toposequence of associations in the ICHj subzone.

A: Subdued topography; B: Steep slopes.

ICHj/01 FALSE AZALEA - QUEEN'S CUP

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/01; *Menziesia* - *Clintonia*; ICHj: False azalea - queen's cup association.



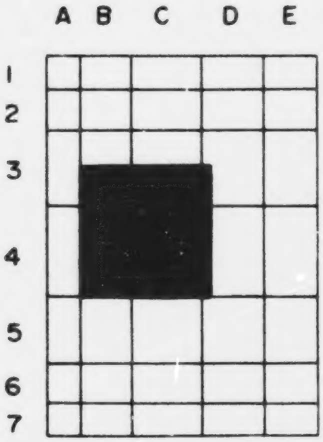
ECOLOGICAL MOISTURE REGIME: submesic - mesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic -
mesotrophic
(- permesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: variable but commonly mid
Soil Texture: medium - coarse

DISTRIBUTION: common



ICHj/01 FALSE AZALEA - QUEEN'S CUP

VEGETATION:

Tree Layer: 75% cover

Tsuga heterophylla	(western hemlock)	
Thuja plicata	(western redcedar)	
Picea glauca x *engelmannii*	(hybrid white spruce)	
Abies lasiocarpa	(subalpine fir)	
[*Pseudotsuga menziesii*	(Douglas-fir)]	)- seral species
[*Pinus contorta*	(lodgepole pine)]	)

Shrub Layer: 25% cover; poorly developed except for regeneration

Thuja plicata		)- regeneration
Tsuga heterophylla		)
[*Abies lasiocarpa*]		)
Menziesia ferruginea	(false azalea)	
Vaccinium membranaceum	(black huckleberry)	
[*Oplopanax horridus*	(devil's club)]	- very low cover
[*Spiraea betulifolia*	(birch-leaved spirea)]	
[*Rubus parviflorus*	(thimbleberry)]	

Herb Layer: 20% cover

Cornus canadensis	(bunchberry)	)- constant dominants
Clintonia uniflora	(queen's cup)	)
Orthilia secunda	(one-sided wintergreen)	
Linnaea borealis	(twinflower)	
Smilacina racemosa	(false Solomon's-seal)	
Chimaphila umbellata	(prince's pine)	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Tiarella unifoliata*	(one-leaved foamflower)]	
[*Gymnocarpium dryopteris*	(oak fern)]	- low cover
[*Streptopus roseus*	(rosy twistedstalk)]	
[*Aralia nudicaulis*	(wild sarsaparilla)]	

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
[*Rhytidiadelphus triquetrus*	(electrified cats'-tail)]

ICHj/01 FALSE AZALEA - QUEEN'S CUP

SOIL AND SITE:

Slope Gradient (%):	19 (0-42)
Parent Material:	glaciofluvial, morainal or fluvial
Soil Classification:	Dystric Brunisol and Orthic Humo-Ferric Podzol
Coarse Fragments (%):	19 (0-40)
Soil Drainage:	well - moderately well
Rooting Depth (cm):	32 (15-50)
Humus Form:	Hemimor, Humimor and Mormoder
Humus Thickness (cm):	9 (3-27, usually less than 10 with thin or no H horizon)
pH Humus:	4.8
pH Mineral:	5.1

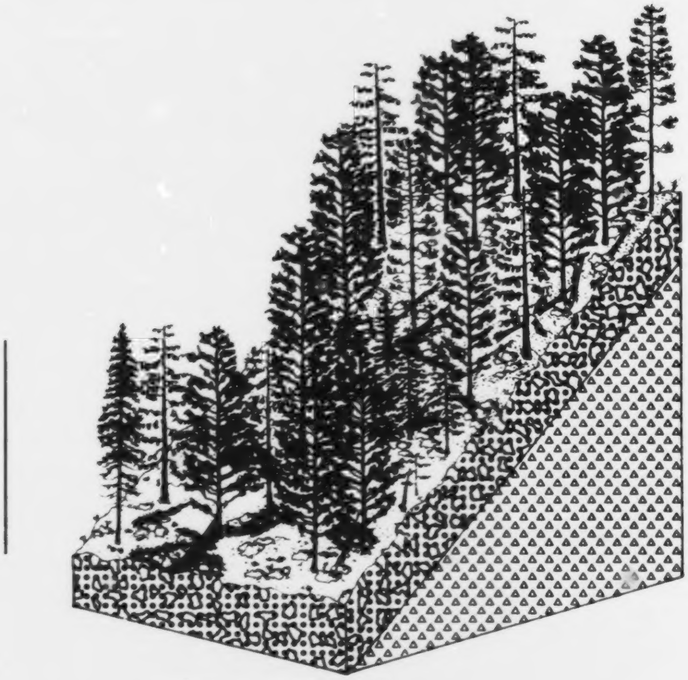
COMMENTS:

Coarse-textured soils receive some seepage during growing season.

ICHj/02 DOUGLAS-FIR - FALSEBOX

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/02; *Pseudotsuga* - *Paxistima*; ICHj: Douglas-fir - falsebox association.



ECOLOGICAL MOISTURE REGIME: xeric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 60 (50-70)
Slope Position: upper - mid
Aspect: W - SSW
Soil Texture: coarse

DISTRIBUTION: uncommon

	A	B	C	D	E
1	■	■			
2					
3					
4					
5					
6					
7					

ICHj/02 DOUGLAS-FIR - FALSEBOX

VEGETATION:

Tree Layer: 70% cover

Pseudotsuga menziesii	(Douglas-fir)	- high cover
Thuja plicata	(western redcedar)	
[*Pinus contorta*	(lodgepole pine)]	- seral
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	

Shrub Layer: 50% cover; high cover of regeneration

Thuja plicata		)- regeneration
Abies lasiocarpa	(subalpine fir)	)
Paxistima myrsinites	(falsebox)	
Menziesia ferruginea	(false azalea)	
[*Shepherdia canadensis*	(soopolallie)]	

Herb Layer: 8% cover; poorly developed

Chimaphila umbellata	(prince's pine)
[*Orthilia secunda*	(one-sided wintergreen)]
[*Linnaea borealis*	(twinflower)]
[*Streptopus roseus*	(rosy twistedstalk)]
[*Pyrola chlorantha*	(green wintergreen)]

Moss Layer: 50% cover

Pleurozium schreberi	(red-stemmed feather moss)	- dominant
[*Rhytidiadelphus triquetrus*	(electrified cat's-tail)]	
[*Barbilophozia* spp.]		
[*Peltigera* spp.]		

SOIL AND SITE:

Parent Material:	usually colluvial
Soil Classification:	Dystric Brunisol
Coarse Fragments (%):	0-80
Soil Drainage:	rapidly to well
Humus Form:	Xeromor
Humus Thickness (cm):	5

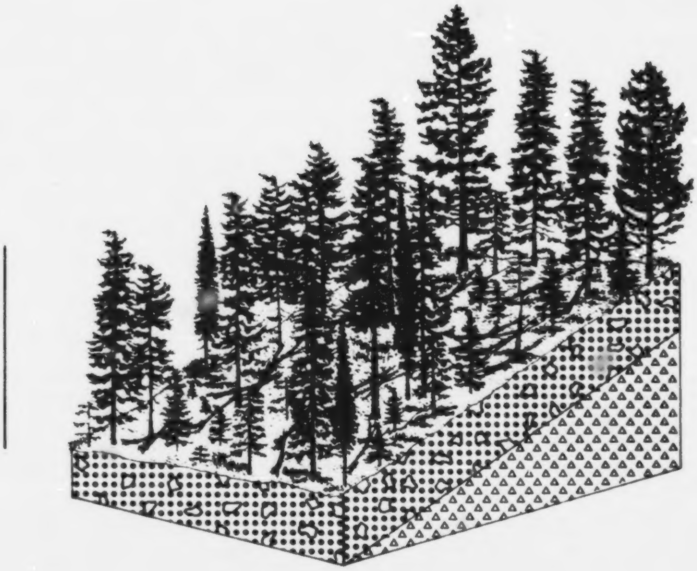
COMMENTS:

There is often a fairly high cover of cobbles and stones on the surface although most of them are covered with bryophytes or lichens. There is limited data for this association.

ICHj/03 HEMLOCK - MOSS

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/03; Tsuga - Pleurozium; ICHj: Hemlock - moss association.



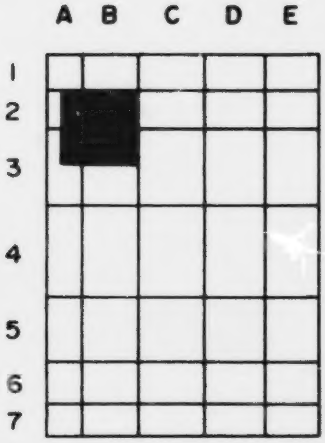
ECOLOGICAL MOISTURE REGIME: subxeric - submesic

ECOLOGICAL NUTRIENT REGIME: (oligotrophic -) submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Soil Texture: coarse and moderately-coarse
Coarse Fragments (%): 41 (0-74; usually greater than 20)

DISTRIBUTION: common



ICHj/03 HEMLOCK - MOSS

VEGETATION:

Tree Layer: 75% cover

Tsuga heterophylla	(western hemlock)	- dominant
[*Thuja plicata*	(western redcedar)]	

Shrub Layer: 25% cover; regeneration accounts for most of the cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Menziesia ferruginea	(false azalea)	
Vaccinium membranaceum	(black huckleberry)	

Herb Layer: 7% cover

Cornus canadensis	(bunchberry)
[*Orthilia secunda*	(one-sided wintergreen)]
[*Chimaphila umbellata*	(prince's pine)]
[*Rubus pedatus*	(five-leaved bramble)]
[*Linnaea borealis*	(twinflower)]
[*Goodyera oblongifolia*	(rattlesnake-plantain)]

Moss Layer: 100% cover

Pleurozium schreberi	(red-stemmed feather moss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
[*Peltigera aphthosa*]	

SOIL AND SITE:

Slope Gradient (%): 35 (0-75)
Slope Position: variable (commonly mid - crest)
Parent Material: variable
Soil Classification: Orthic Humo-Ferric Podzol (occasionally Orthic Dystric Brunisol)
Soil Drainage: rapidly - well
Rooting Depth (cm.): 44 (10-100)
Humus Form: Mor (usually Hemimor)
Humus Thickness (cm.): 6 (4-14; usually less than 7)
pH Humus: 3.8
pH Mineral: 4.4

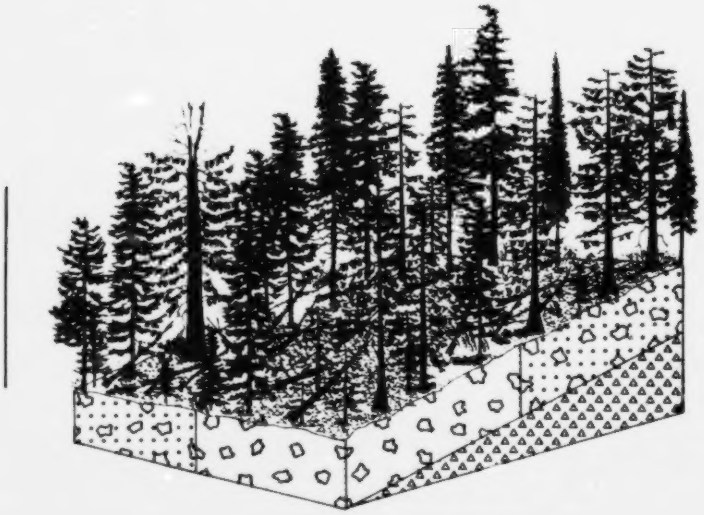
COMMENTS:

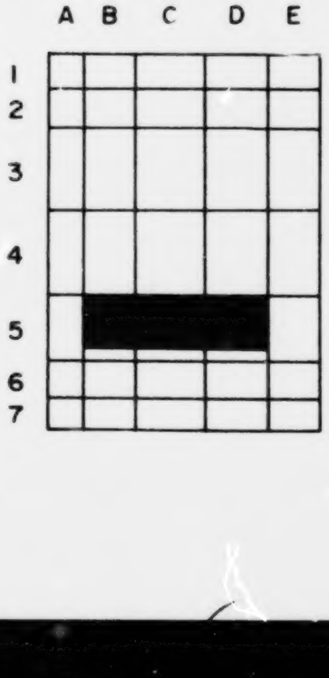
Where site position is not mid to upper, the parent materials are usually gravelly fluvial deposits. Humus form very rarely contains H material.

ICHj/04 OAK FERN - STEP MOSS

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/04; Gymnocarpium - Hylocomium; ICHj: Oak fern - step moss association.





ECOLOGICAL MOISTURE REGIME: subhygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - permesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 23 (8-39)
Slope Position: mid - lower
Seepage Water: may be present

DISTRIBUTION: common

ICHj/04 OAK FERN - STEP MOSS

VEGETATION:

Tree Layer: 75% cover

Thuja plicata	(western redcedar)	
Tsuga heterophylla	(western hemlock)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 25% cover; regeneration accounts for the most cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
[*Abies lasiocarpa*]		)
Menziesia ferruginea	(false azalea)	
Vaccinium membranaceum	(black huckleberry)	
[*Oplopanax horridus*	(devil's club)]	- low cover

Herb Layer: 55% cover

Gymnocarpium dryopteris	(oak fern)	- mod. to high cover
Cornus canadensis	(bunchberry)	
Tiarella unifoliata	(one-leaved foamflower)	
Clintonia uniflora	(queen's cup)	
Streptopus roseus	(rosy twistedstalk)	
Orthilia secunda	(one-sided wintergreen)	
[*Moneses uniflora*	(single delight)]	
[*Rubus pedatus*	(five-leaved bramble)]	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Streptopus amplexifolius*	(clasping-leaved twistedstalk)]	
[*Linnaea borealis*	(twinflower)]	
[*Aralia nudicaulis*	(wild sarsaparilla)]	

Moss Layer: 60% cover

Hylocomium splendens	(step moss)	
Pleurozium schreberi	(red-stemmed feather moss)	
Ptilium crista-castrensis	(knight's plume)	
[*Mnium* spp.]	(leafy mosses)	- good indicators, but low cover
[*Brachythecium hylotapetum*]		

ICHj/04 OAK FERN - STEP MOSS

SOIL AND SITE:

Parent Material:	variable
Soil Classification:	dominantly gleyed subgroups (often Humo-Ferric Podzol)
Soil Texture:	variable (moderately fine, medium and moderately coarse)
Coarse Fragments (%):	41 (0-91)
Soil Drainage:	moderately well - imperfectly
Rooting Depth (cm):	40 (15-90)
Humus Form:	Humimor and Mormoder
Humus Thickness (cm):	8 (usually has H horizon)
pH Humus:	4.5
pH Mineral:	4.8

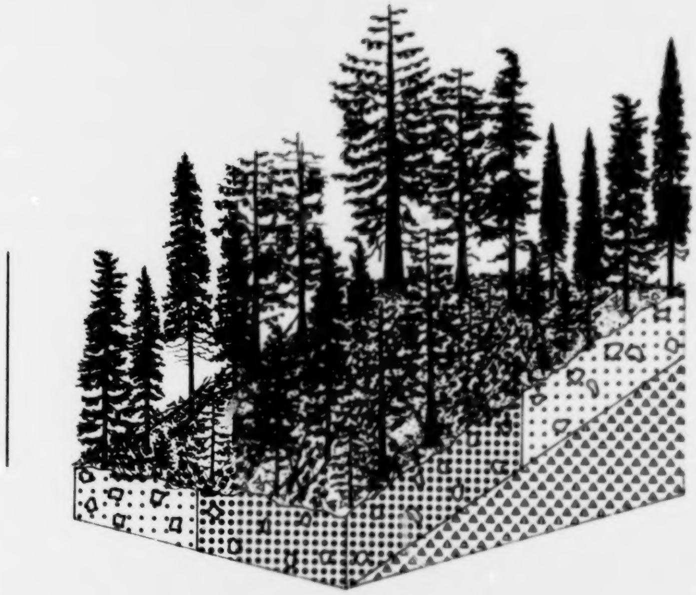
COMMENTS:

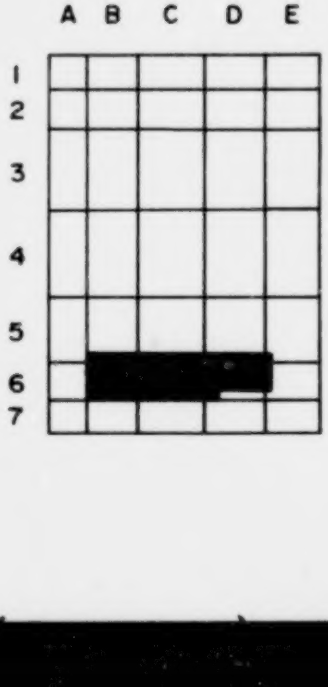
Seepage water may be present as these sites receive some seepage early in the growing season and possibly after heavy precipitation.

ICHj/05 DEVIL'S CLUB - OAK FERN

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/05; *Oplopanax* - *Gymnocarpium*; ICHj: Devil's club - oak fern association.





ECOLOGICAL MOISTURE REGIME: subhygric - hygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 26 (4-75; usually less than 40)
Slope Position: commonly lower - toe

DISTRIBUTION: very common

ICHj/05 DEVIL'S CLUB - OAK FERN

VEGETATION:

Tree Layer: 70% cover

Thuja plicata	(western redcedar)	
Tsuga heterophylla	(western hemlock)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 60% cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Abies lasiocarpa		)
Oplopanax horridus	(devil's club)	- mod. to high cover
Ribes lacustre	(black gooseberry)	
Menziesia ferruginea	(false azalea)	
Rubus parviflorus	(thimbleberry)	

Herb Layer: 45% cover

Gymnocarpium dryopteris	(oak fern)	- moderate cover
Tiarella unifoliata	(one-leaved foamflower)	
Streptopus amplexifolius	(clasping twistedstalk)	
Cornus canadensis	(bunchberry)	
Smilacina racemosa	(false Solomon's-seal)	
Dryopteris assimilis	(spiny wood fern)	
Streptopus roseus	(rosy twistedstalk)	
Clintonia uniflora	(queen's cup)	
Rubus pedatus	(five-leaved bramble)	
[*Galium triflorum*	(sweet-scented bedstraw)]	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Moneses uniflora*	(single delight)]	

Moss Layer: 40% cover

Mnium spp.	(leafy mosses)
Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
Rhytidiadelphus triquetrus	(electrified cat's-tail)

ICHj/05 DEVIL'S CLUB

SOIL AND SITE:

Parent Material:	variable (commonly morainal, fluvial or glaciofluvial)
Soil Classification:	dominantly gleyed subgroups or Gleysols
Soil Texture:	dominantly medium and coarse
Coarse Fragments (%):	36 (0-80)
Soil Drainage:	moderately well - poorly
Rooting Depth (cm):	56 (15-100)
Seepage Water:	may be present
Humus Form:	Humimor, Mormoder and Leptomoder
Humus Thickness (cm):	8 (usually less than 10 with H horizon present)
pH Humus:	4.8
pH Mineral:	5.0

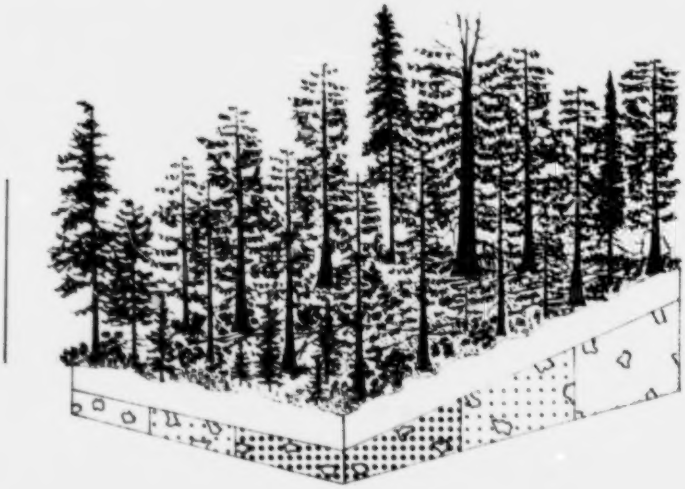
COMMENTS:

Coarse-textured soils compensated by seepage. All sites receive some seepage during the growing season.

ICHj/06 DEVIL'S CLUB - HORSETAIL

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/06; Oplopanax - Equisetum; ICHj: Devil's club - horsetail association.



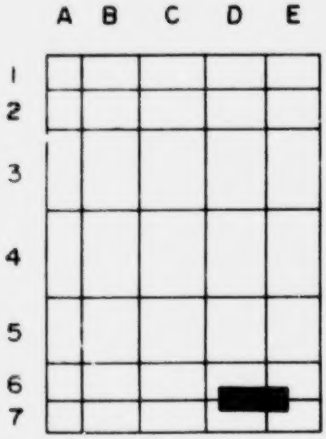
ECOLOGICAL MOISTURE REGIME: hygric

ECOLOGICAL NUTRIENT REGIME: permesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: lower - toe
Humus Thickness (cm): greater than 30
Seepage Water: present

DISTRIBUTION: uncommon



ICHj/06 DEVIL'S CLUB - HORSETAIL

VEGETATION:

Tree Layer: 70% cover

Thuja plicata	(western redcedar)	- dominant
[Picea glauca x engelmannii	(hybrid white spruce)]	
[Abies lasiocarpa	(subalpine fir)]	
[Tsuga heterophylla	(western hemlock)]	

Shrub Layer: 40% cover

Thuja plicata		)- regeneration
Abies lasiocarpa		)
[Tsuga heterophylla]		)
[Picea glauca x engelmannii]		)
Oplopanax horridus	(devil's club)	- moderate cover
Acer glabrum	(Douglas maple)	
Viburnum edule	(highbush-cranberry)	
[Ribes lacustre	(black gooseberry)]	
[Rubus parviflorus	(thimbleberry)]	
[Cornus sericea	(red-osier dogwood)]	

Herb Layer: 75% cover

Equisetum arvense	(common horsetail)	)- characteristic dominants,
Equisetum pratense	(meadow horsetail)	) individually or in combination
Gymnocarpium dryopteris	(oak fern)	
Cornus canadensis	(bunchberry)	
Mitella nuda	(common mitrewort)	
Equisetum scirpoides	(dwarf scouring-rush)	
[Actaea rubra	(baneberry)]	
[Smilacina racemosa	(false Solomon's-seal)]	
[Galium triflorum	(sweet-scented bedstraw)]	
[Cinna latifolia	(nodding wood-reed)]	
[Lycopodium annotinum	(stiff club-moss)]	
[Rubus pubescens	(trailing raspberry)]	

Moss Layer: 50% cover

Mnium spp.	(leafy mosses)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
Hylocomium splendens	(step moss)
Brachythecium spp.	

ICHj/06 DEVIL'S CLUB - HORSETAIL

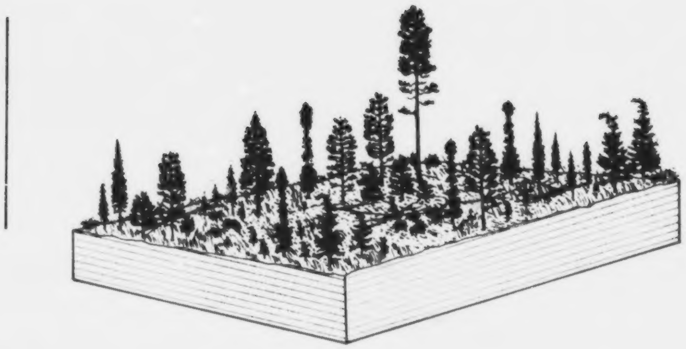
SOIL AND SITE:

Slope Gradient (%):	15 (0-30)
Parent Material:	lacustrine or fluvial
Soil Classification:	organic, and peaty-phase Gleysol
Soil Texture:	variable
Coarse Fragments (%):	variable
Soil Drainage:	poorly
Rooting Depth (cm):	majority of roots in organic horizons
Humus Form:	Hydromor and Saprimull
pH Humus:	5.6
pH Mineral:	5.4

ICHj/07 BLACK SPRUCE - SPHAGNUM

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/07; Picea (mariana) - Sphagnum; ICHj: Black spruce - sphagnum association.



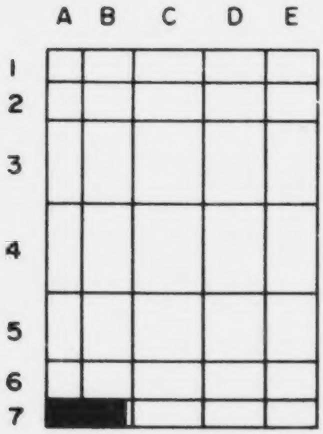
ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: depression
Water Table (cm): 0-30

DISTRIBUTION: rare



ICHj/07 BLACK SPRUCE - SPHAGNUM

VEGETATION:

Tree Layer: 25% cover; poorly developed; usually clumped

Picea mariana	(black spruce)
[*Pinus contorta*	(lodgepole pine)]

Shrub Layer: 20% cover

Tsuga heterophylla	(western hemlock)	)- regeneration
Pinus contorta		)
Picea mariana		)
[*Thuja plicata*	(western redcedar)]	)
Ledum groenlandicum	(Labrador tea)	- high cover
Kalmia microphylla ssp. *occidentalis*	(bog-laurel)	

Herb Layer: 75% cover; mostly sedges

Carex spp.	(sedges)	- high cover
Cornus canadensis	(bunchberry)	
Equisetum sylvaticum	(wood horsetail)	
Vaccinium oxycoccos	(bog cranberry)	
Empetrum nigrum	(crowberry)	
Gaultheria hispidula	(creeping-snowberry)	

Moss Layer: 90% cover; well-developed; mostly sphagnum mosses

Sphagnum spp. (*recurvum*, *magellanicum*, *capillaceum*)	(sphagnums)	- high cover
[*Aulacomnium palustre*]	(ribbed bog moss)	- wet microsites
[*Pleurozium schreberi*]	(red-stemmed feather moss]	- dry microsites

SOIL AND SITE:

Slope Gradient (%): 0
Parent Material: organic
Soil Classification: Fibrisol and Mesisol
Soil Drainage: very poorly
Humus Form: Histomoder and Histomor

COMMENTS:

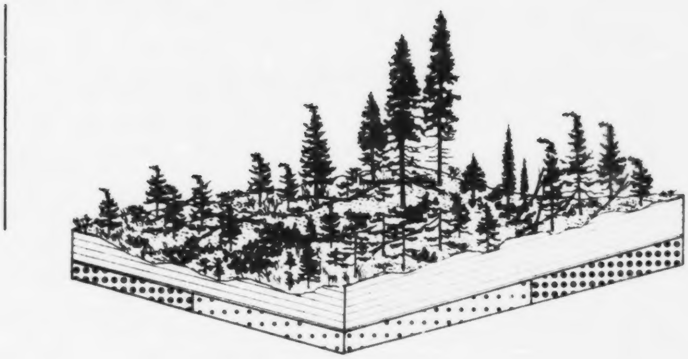
Bog ecosystems are very rare in this subzone. Nutrient-poorer bogs have a lower cover of sedges.

The description is based on limited data.

ICHj/08 SKUNK CABBAGE - SPHAGNUM

BIOGEOCLIMATIC UNIT: ICHj

ECOSYSTEM UNIT: ICHj/08; Lysichiton - Sphagnum; ICHj: Skunk cabbage - sphagnum association.



ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 0-5
Slope Position: depression

DISTRIBUTION: rare

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ICHj/08 SKUNK CABBAGE - SPHAGNUM

VEGETATION:

Tree Layer: 25% cover

Tsuga heterophylla	(western hemlock)	
Thuja plicata	(western redcedar)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 60% cover; high cover of regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata		)
[*Abies lasiocarpa*]		)
[*Picea glauca* x *engelmannii*]		)
Vaccinium ovalifolium	(oval-leaved blueberry)	
Menziesia ferruginea	(false azalea)	
[*Vaccinium membranaceum*	(black huckleberry)]	
[*Oplopanax horridus*	(devil's club)]	

Herb Layer: 50% cover

Lysichiton americanum	(skunk cabbage)	- high cover
Carex interior	(inland sedge)	
Rubus pedatus	(five-leaved bramble)	
Cornus canadensis	(bunchberry)	- drier microsites
Gymnocarpium dryopteris	(oak fern)	
Dryopteris assimilis	(spiny wood fern)	
Equisetum sylvaticum	(wood horsetail)	
[*Carex* spp.	(sedges)]	
[*Cinna latifolia*	(nodding wood-reed)]	
[*Calamagrostis canadensis*	(bluejoint)]	
[*Stellaria crispa*	(crisp starwort)]	

Moss Layer: 95% cover

Sphagnum recurvum		- high cover
Pleurozium schreberi	(red-stemmed feather moss)	
Mnium nudum		
Sphagnum capillaceum	(common red sphagnum)	
[*Pellia neesiana*]		
[*Barbilophozia lycopodioides*	(common leafy liverwort)]	

ICHj/08 SKUNK CABBAGE - SPHAGNUM

SOIL AND SITE:

Parent Material:	usually organic
Soil Classification:	Organic and peaty-phase Gleysol
Coarse Fragments (%):	variable
Soil Drainage:	very poorly
Seepage Water (cm):	0-30
Humus Form:	Hydromull and Saprimull

COMMENTS:

Limited data due to rarity of ecosystem. Seepage water moves very slowly through these sites.

6.2.1 Discussion

Eight associations have been described in the ICHj subzone. The ranges of moisture and nutrient regimes occupied by these associations are represented in Figure 6.3.

The generalized position of each association within a catchment area is represented by Figure 6.4. Steep topography is much more common than subdued topography in this subzone.

The most common association in this subzone is the ICHj/05, the Devil's club association. Approximately 50% of the subzone is occupied by this association. The ICHj/04 association is also common. The ICHj/02, ICHj/06, ICHj/06, ICHj/07, and ICHj/08 associations are all uncommon or rare, and small in area; in total, they probably occupy less than 5% of the subzone.

Seral stands occur frequently. These stands are often mixed, with common species being Douglas-fir, trembling aspen, and western hemlock. On drier sites, lodgepole pine is often a component of seral stands. These seral ecosystems often have a dense tree cover and low cover of shrubs and herbs. Stands that contain aspen have a greater cover of understory vegetation.

The associations described in detail in Section 6 are the major climax associations in the subzone. Other, rare, associations do occur. In the valley bottom of Hugh Allen Creek, an association has been recognized that is not described in Section 6. It is characterized by a tree cover of Picea glauca x engelmannii and Populus tremuloides, very high shrub cover, primarily of Rubus parviflorus, and a well-developed herb layer that is dominated by Aralia nudicaulis, but which also has a moderate cover of Cornus canadensis, Elmyus glaucus, Oryzopsis asperifolia and Actaea rubra. The moss layer is moderately developed. The moisture regime of these sites is mesic to subhygric. Their development appears to be a function of cold-air drainage in the wide valley-bottom.

Dense stands, usually dominated by western hemlock, also occur where the soil and site factors indicate that the ecosystem is wetter than indicated by the plant association, e.g. a subhygric to hygric site with little or no devil's club. Understory development in these stands appears to be limited by the dense tree cover, and classification on vegetation alone usually places the site in an incorrect association.

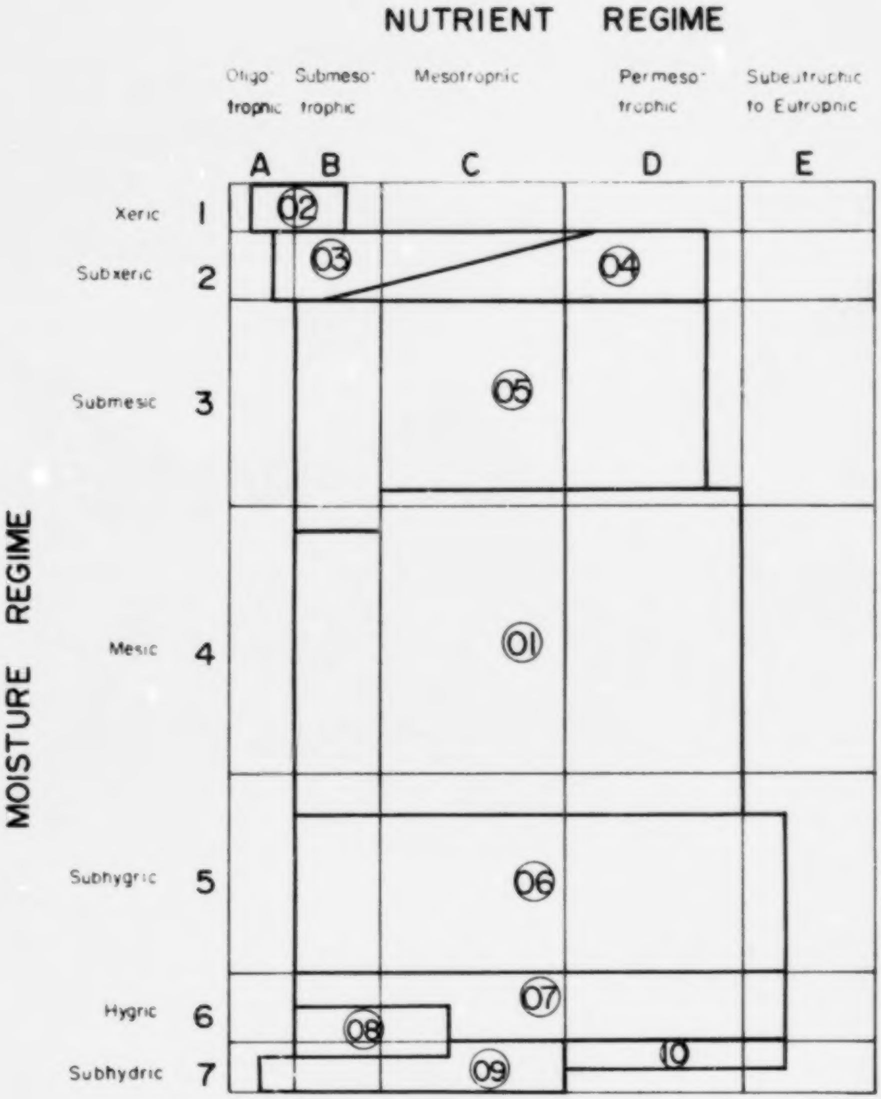
6.3 Ecosystem Units of the ICHk

TABLE 6.3 Ecosystem (biogeocoenotic) units of the Wet Northern Interior Cedar - Hemlock subzone (ICHk)

Code	Ecosystem Unit	Scientific name	Common name
ICHk/01	association	Gymnocarpium - Hylocomium	Oak fern - step moss
ICHk/01(a)	phase		Oak fern - step moss, coarse-textured phase
ICHk/01(b)	phase		Oak fern - step moss, fine-textured phase
ICHk/02	association	Tsuga - Cladonia	Hemlock - lichen
ICHk/03	association	Thuja - Pleurozium	Cedar - moss
ICHk/04	association	Tsuga - Hylocomium	Hemlock - step moss
ICHk/05	association	Rubus (pedatus) - Hylocomium	Bramble - step moss
ICHk/06	association	Oplopanax - Gymnocarpium	Devil's club - oak fern
ICHk/06(a)	phase		Devil's club - oak fern, coarse-textured phase
ICHk/06(b)	phase		Devil's club - oak fern, fine-textured phase
ICHk/07	association	Lonicera - Equisetum	Black twinberry - horsetail
ICHk/07(a)	phase		Black twinberry - horsetail, fluvial phase
ICHk/07(b)	phase		Black twinberry - horsetail, lacustrine phase
ICHk/08	association	Tsuga - Equisetum	Hemlock - horsetail

TABLE 6.3 (continued)

Code	Ecosystem unit	Scientific name	Common name
ICHk/08.1	subassociation	*Tsuga* - *Equisetum* - *Hylocomium*	Hemlock - horsetail - step moss
ICHk/08.2	subassociation	*Tsuga* - *Equisetum* - *Sphagnum*	Hemlock - horsetail - sphagnum
ICHk/09	association	*Alnus* (*incana* ssp. *tenuifolia*) - *Lysichiton*	Mountain alder - skunk cabbage
ICHk/10	association	*Pinus* - *Sphagnum*	Pine - sphagnum


NUTRIENT REGIME
Oligo-trophic
Submeso-trophic
Mesotrophic
Permeso-trophic
Subeutrophic to Eutrophic
A
B
C
D
E
MOISTURE REGIME
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02
03
04
05
01
06
07
08
09
10

ICHk Associations

01 Oak Fern-Step Moss
02 Hemlock-Lichen
03 Cedar-Moss
04 Hemlock-Step Moss
05 Bramble-Step Moss
06 Devil's Club-Oak Fern
07 Black Twinberry-Horsetail
08 Hemlock-Horsetail-Sphagnum
09 Mountain Alder-Skunk Cabbage
10 Pine-Sphagnum

FIG. 6.5 Edatopic grid of ecological moisture and nutrient regime for the ICHk subzone.

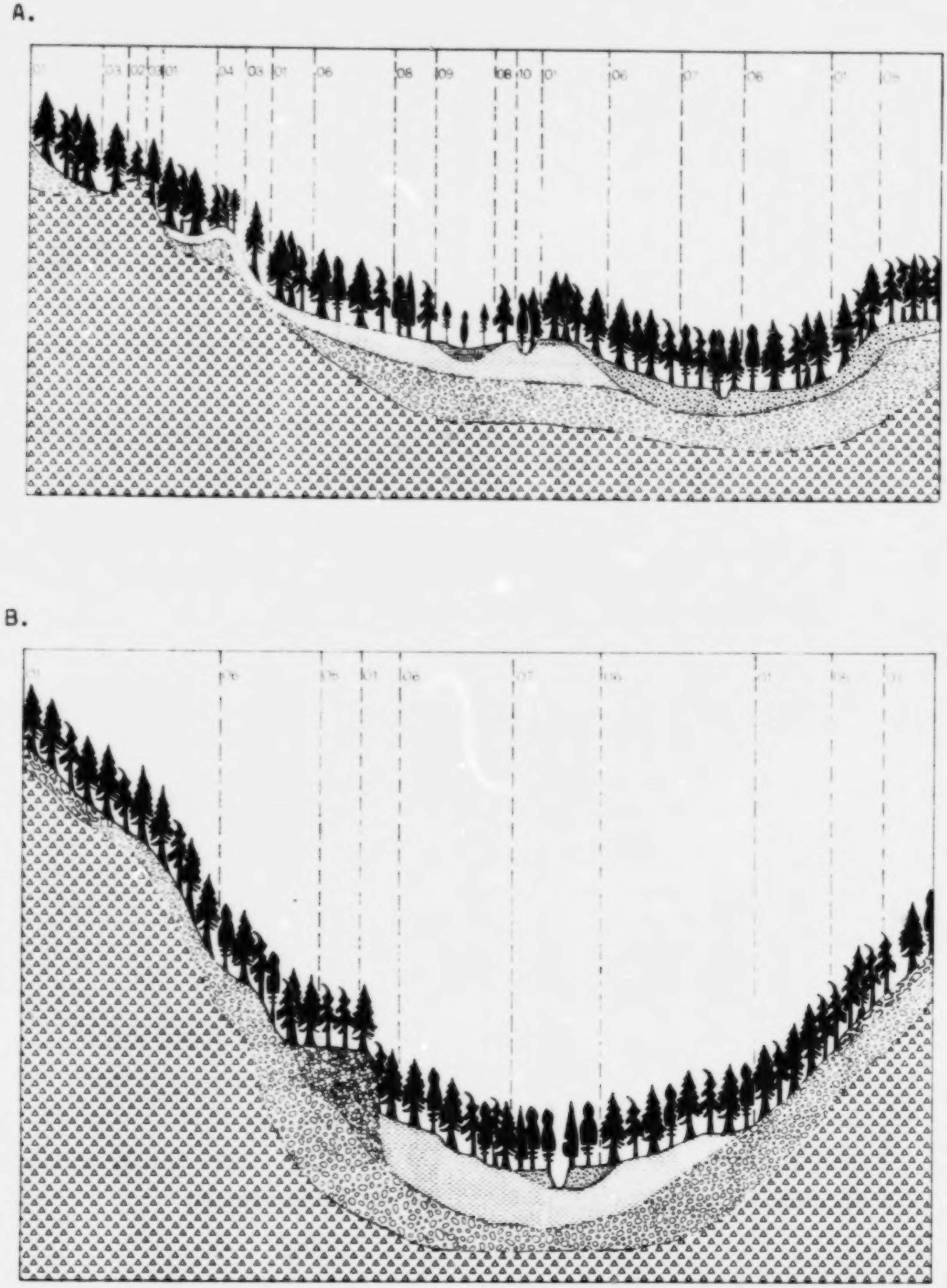

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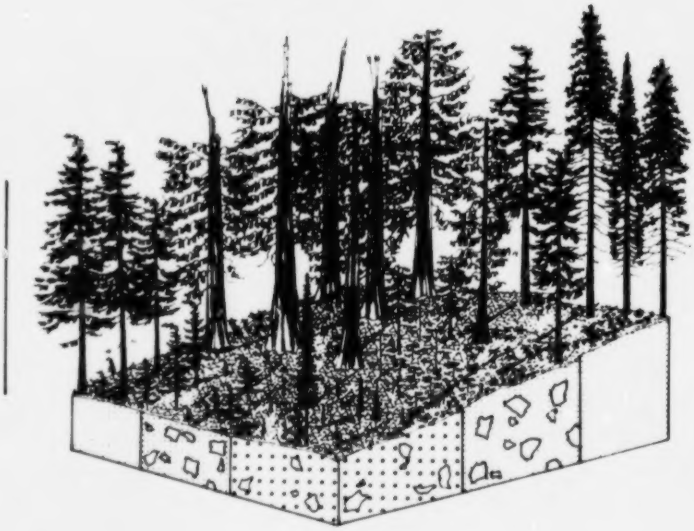
FIG. 6.6. Toposequence of associations in the ICHk subzone.
A: Subdued topography; B: Steep slopes.

ICHk/01 OAK FERN -- STEP MOSS

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/01; Gymnocarpium - Hylocomium; ICHk: Oak fern - step moss association.



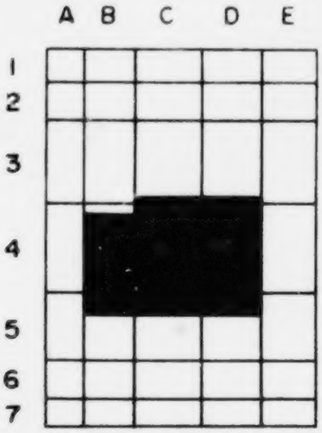
ECOLOGICAL MOISTURE REGIME: mesic (submesic - subhygric)

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic (- permesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: usually mid
Parent Material: two phases: one lacustrine; the other morainal, fluvial, or colluvial

DISTRIBUTION: very common



ICHk/01 OAK FERN - STEP MOSS

VEGETATION:

Tree Layer: 70% cover

Thuja plicata	(western redcedar)	
Tsuga heterophylla	(western hemlock)	
[*Abies lasiocarpa*	(subalpine fir)]	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	

Shrub Layer: 30% cover; mostly regeneration

Thuja plicata		)- regeneration
Tsuga heterophylla		)
Abies lasiocarpa		)
[*Picea glauca* x *engelmannii*]		)
Oplopanax horridus	(devil's club)	- low to mod. cover
Vaccinium membranaceum	(black huckleberry)	
Menziesia ferruginea	(false azalea)	
[*Ribes lacustre*	(black gooseberry)]	
[*Vaccinium ovalifolium*	(oval-leaved blueberry)]	
[*Acer glabrum*	(Douglas maple)]	
[*Sorbus* spp.	(mountain-ashes)]	

Herb Layer: 70% cover

Gymnocarpium dryopteris	(oak fern)	- dominant; high cover
Cornus canadensis	(bunchberry)	
Rubus pedatus	(five-leaved bramble)	
Tiarella unifoliata	(one-leaved foamflower)	
Clintonia uniflora	(queen's cup)	
Streptopus roseus	(rosy twistedstalk)	
Orthilia secunda	(one-sided wintergreen)	
Smilacina racemosa	(false Solomon's-seal)	
Goodyera oblongifolia	(rattlesnake-plantain)	
Aralia nudicaulis	(wild sarsaparilla)	
[*Tiarella trifoliata*	(three-leaved foamflower)]	
[*Moneses uniflora*	(single delight)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	
[*Lycopodium annotinum*	(stiff club-moss)]	
[*Athyrium filix-femina*	(lady fern)]	
[*Mitella nuda*	(common mitrewort)]	
[*Dryopteris assimilis*	(spiny wood fern)]	
[*Goodyera repens*	(dwarf rattlesnake orchid)]	

Moss Layer: 70% cover

Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
[*Mnium* spp.	(leafy mosses)]

ICHk/01 OAK FERN - STEP MOSS

SOIL AND SITE:

ICHk/01(a) COARSE-TEXTURED PHASE

Moisture Regime:	submesic - subhygric
Nutrient Regime:	submesotrophic - mesotrophic
Slope Gradient (%):	21 (3-67; rarely greater than 30)
Parent Material:	morainal and fluvial
Soil Classification:	usually Humo-Ferric Podzol; also Brunisol and Luvisol
Soil Texture:	medium - moderately coarse
Coarse Fragments (%):	25 (0-54)
Soil Drainage:	well - imperfectly
Seepage Water:	rarely present
Rooting Depth (cm):	37 (20-70)
Humus Thickness (cm):	8 (6-10)
Humus Form:	Hemimor, Humimor and Mormoder
pH Humus:	4.8
pH Mineral:	4.5

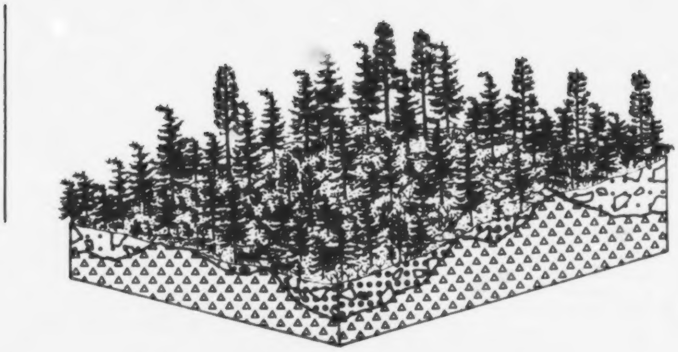
ICHk/01(b) FINE-TEXTURED PHASE

Moisture Regime:	mesic - subhygric
Nutrient Regime:	mesotrophic - permesotrophic
Slope Gradient (%):	10 (0-65; usually less than 15)
Parent Material:	lacustrine
Soil Classification:	Brunisolic and Podzolic Gray Luvisol; often gleyed
Soil Texture:	medium - fine
Coarse Fragments (%):	usually zero
Soil Drainage:	moderately well - imperfectly
Seepage Water:	rarely present
Rooting Depth (cm):	22 (15-35)
Humus Thickness (cm):	7 (4-11)
Humus Form:	Hemihumimor and Mormoder
pH Humus:	4.1
pH Mineral:	4.3

ICHk/02 HEMLOCK - LICHEN

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/02; _Tsuga_ - _Cladonia_; ICHk: Hemlock - lichen association.



ECOLOGICAL MOISTURE REGIME: xeric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: crest - upper
Parent Material: bedrock and shallow veneer over bedrock

DISTRIBUTION: very rare

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ICHk/02 HEMLOCK - LICHEN

VEGETATION:

Tree Layer: 35% cover; open stands of stunted trees

Tsuga heterophylla	(western hemlock)	- dominant
Pinus contorta	(lodgepole pine)	

Shrub Layer: 65% cover; high cover of regeneration, especially hemlock

Tsuga heterophylla		)- regeneration
Pinus contorta		)
[*Abies lasiocarpa*	(subalpine fir)]	)
Menziesia ferruginea	(rusty false azalea)	
Vaccinium membranaceum	(black huckleberry)	
Vaccinium ovalifolium	(oval-leaved blueberry)	

Herb Layer: 5% cover; very poorly developed

Empetrum nigrum	(crowberry)

Moss Layer: 100% cover

Pleurozium schreberi	(red-stemmed feather moss)	- high cover
Cladina spp.		
Cladonia spp.		
Stereocaulon paschale		
[*Dicranum polysetum*]		
[*Peltigera* spp.]		

SOIL AND SITE:

Slope Gradient (%): 2 (0-30)
Soil Classification: Orthic Humo-Ferric Podzol and Brunisol
Soil Texture: medium to coarse
Soil Drainage: rapidly
Humus Form: Xeromor

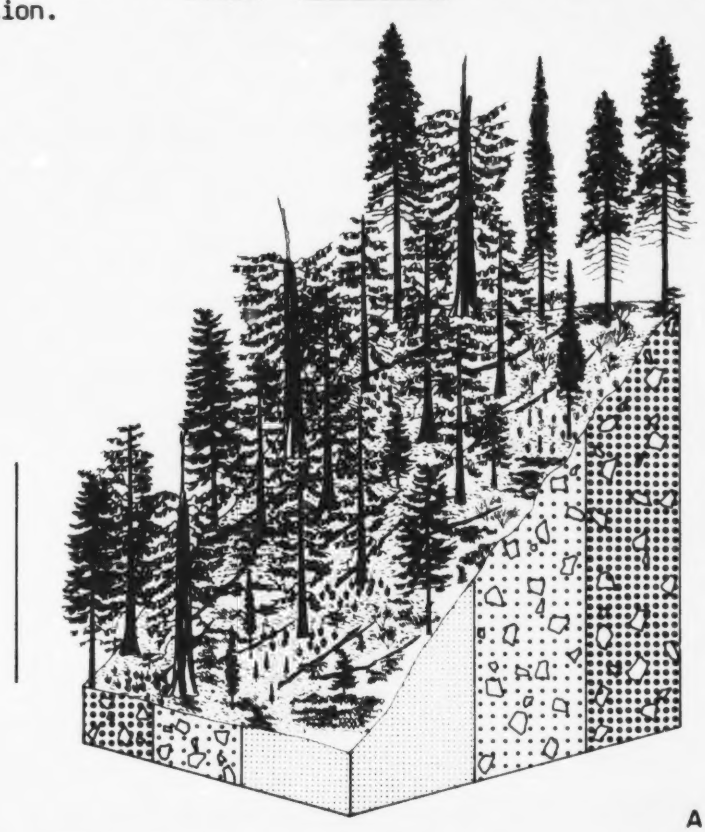
COMMENTS:

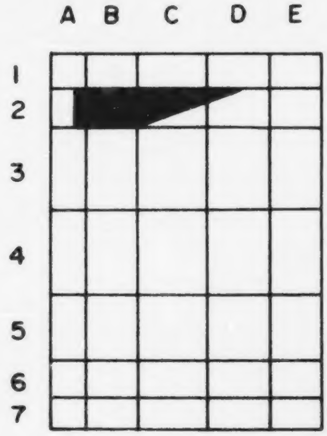
High cover (35%) of exposed bedrock. Limited data due to rarity of ecosystem.

ICHk/03 CEDAR - MOSS

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/03; *Thuja* - *Pleurozium*; ICHk: Cedar - moss association.





ECOLOGICAL MOISTURE REGIME: subxeric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: upper
Slope Gradient (%): 72 (55-82)
Aspect: usually SE - SW

DISTRIBUTION: uncommon

ICHk/03 CEDAR - MOSS

VEGETATION:

Tree Layer: 50% cover

Thuja plicata	(western redcedar)	- dominant
Tsuga heterophylla	(western hemlock)	
Picea glauca x engelmannii	(hybrid white spruce)	
Abies lasiocarpa	(subalpine fir)	

Shrub Layer: 15% cover; mostly regeneration

Thuja plicata		)- regeneration
Tsuga heterophylla		)
Abies lasiocarpa		)
[Betula papyrifera	(paper birch)	)
Acer glabrum	(Douglas maple)	
[Ribes lacustre	(black gooseberry)]	
[Amelanchier alnifolia	(Saskatoon)]	
[Spiraea betulifolia	(birch-leaved spirea)]	
[Viburnum edule	(highbush-cranberry)]	

Herb Layer: 15% cover

Chimaphila umbellata	(prince's pine)	
Gymnocarpium dryopteris	(oak fern)	- low cover
Smilacina racemosa	(false Solomon's-seal)	
Orthilia secunda	(one-sided wintergreen)	
Clintonia uniflora	(queen's cup)	
Cornus canadensis	(bunchberry)	
Disporum hookeri	(Hooker's fairybells)	
Aralia nudicaulis	(wild sarsaparilla)	
[Maianthemum canadense	(wild lily-of-the-valley)]	
[Actaea rubra	(baneberry)]	
[Moneses uniflora	(single delight)]	
[Streptopus amplexifolius	(clasping twistedstalk)]	
[Goodyera oblongifolia	(rattlesnake-plantain)]	

Moss Layer: 50% cover

Pleurozium schreberi	(red-stemmed feather moss)
Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
Ptilium crista-castrensis	(knight's plume)
[Peltigera aphthosa]	

ICHk/03 CEDAR - MOSS

SOIL AND SITE:

Parent Material: colluvial and steep lacustrine
Soil Classification: Brunisol, Orthic Humo-Ferric Podzol and Brunisolic Gray Luvisol
Soil Texture: moderately fine - moderately coarse
Coarse Fragments (%): 28 (0-84, greater than 50 if non-lacustrine)
Soil Drainage: rapidly - well
Rooting Depth (cm): 53 (26-74)
Humus Thickness (cm): 9 (7-10)
Humus Form: Hemimor and Mormoder
pH Mineral: 4.6

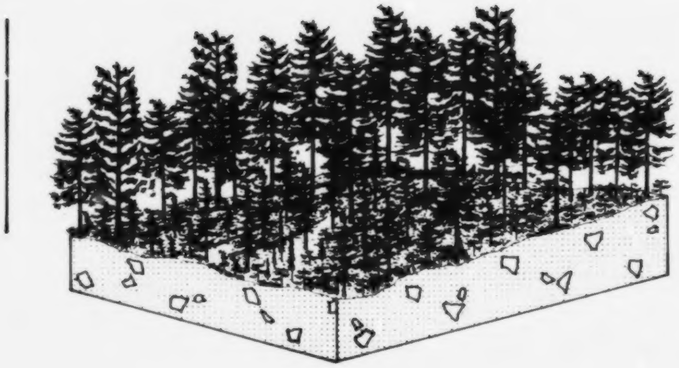
COMMENTS:

This ecosystem could occur on other parent materials within the subzone, but none were found in the present study.

ICHk/04 HEMLOCK - STEP MOSS

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/04; *Tsuga* - *Hylocomium*; ICHk: Hemlock - step moss association.



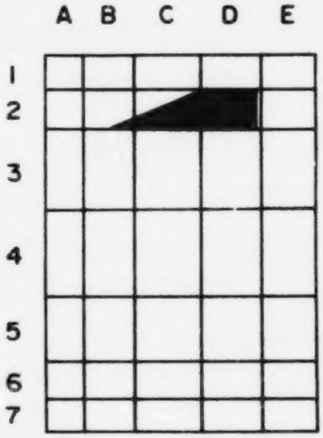
ECOLOGICAL MOISTURE REGIME: subxeric

ECOLOGICAL NUTRIENT REGIME: mesotrophic - permesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: crest - upper
Parent Material: lacustrine veneer or blanket over bedrock
Soil Texture: fine and moderately fine

DISTRIBUTION: rare



ICHk/04 HEMLOCK - STEP MOSS

VEGETATION:

Tree Layer: 80% cover; dense stands

Tsuga heterophylla	(western hemlock)	- dominant
Pseudotsuga menziesii	(Douglas-fir)	- seral

Shrub Layer: 35% cover; mostly regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Abies lasiocarpa	(subalpine fir)	)
Menziesia ferruginea	(false azalea)	
[*Vaccinium ovalifolium*	(oval-leaved blueberry)]	
[*Vaccinium membranaceum*	(black huckleberry)]	
[*Amelanchier alnifolia*	(Saskatoon)]	

Herb Layer: 10% cover; poorly developed

Chimaphila umbellata	(prince's pine)	
Cornus canadensis	(bunchberry)	
Orthilia secunda	(one-sided wintergreen)	
Clintonia uniflora	(queen's cup)	
[*Gaultheria hispidula*	(creeping-snowberry)]	- good indicator
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	

Moss Layer: 100% cover

Hylocomium splendens	(step moss)	- dominant
Pleurozium schreberi	(red-stemmed feather moss)	
Ptilium crista-castrensis	(knight's plume)	
Peltigera leucophlebia		
[*Cladina mitis*]		
[*Barbilophozia barbata*]		
[*Nephroma arcticum*]		

SOIL AND SITE:

Slope Gradient (%): 6 (5-8)
Soil Classification: Brunisolic, Podzolic and Orthic Gray Luvisols
Coarse Fragments (%): usually zero (always less than 10)
Soil Drainage: well
Humus Thickness (cm.): 10 (5-12)
Humus Form: Hemimor and Mormoder

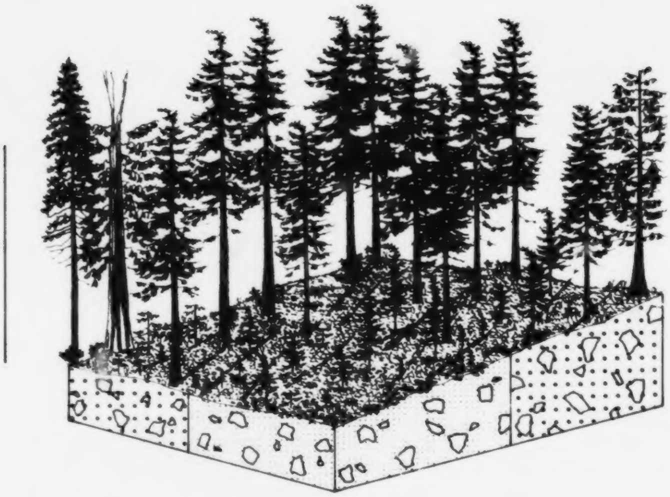
COMMENTS:

Limited data due to rarity of ecosystem.

ICHk/05 BRAMBLE - STEP MOSS

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/05; Rubus (pedatus) - Hylocomium; ICHk: Bramble - step moss association.



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ECOLOGICAL MOISTURE REGIME: submesic (- mesic)

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic (- permesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Parent Material: usually fluvial; occasionally lacustrine or morainal veneers
Soil Texture: medium - moderately coarse
Slope Position: variable; upper - crest if fine-textured

DISTRIBUTION: common

ICHk/05 BRAMBLE - STEP MOSS

VEGETATION:

Tree Layer: 75% cover

Tsuga heterophylla	(western hemlock)	- dominant
Thuja plicata	(western redcedar)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 30% cover; mostly regeneration

Tsuga heterophylla		)- regeneration
[*Thuja plicata*]		)
Oplopanax horridus	(devil's club)	- low cover
Menziesia ferruginea	(rusty false azalea)	
Vaccinium membranaceum	(black huckleberry)	
Vaccinium ovalifolium	(oval-leaved blueberry)	
[*Sorbus* spp.	(mountain-ashes)]	

Herb Layer: 70% cover

Gymnocarpium dryopteris	(oak fern)	)- dominants
Rubus pedatus	(five-leaved bramble)	)
Cornus canadensis	(bunchberry)	)
Clintonia uniflora	(queen's cup)	
Tiarella unifoliata	(one-leaved foamflower)	
Streptopus streptopoides	(small twistedstalk)	
Lycopodium annotinum	(stiff club-moss)	
Orthilia secunda	(one-sided wintergreen)	
Streptopus roseus	(rosy twistedstalk)	
[*Dryopteris assimilis*	(spiny wood fern)]	
[*Moneses uniflora*	(single delight)]	
[*Tiarella trifoliata*	(three-leaved foamflower)]	

Moss Layer: 100% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
Rhytidiadelphus triquetrus	(electrified cat's-tail)

SOIL AND SITE:

Slope Gradient (%): 16 (0-50)
Soil Classification: Humo-Ferric Podzol (Orthic, Luvisolic and Gleyed)
Coarse Fragments (%): 30 (2-60)
Soil Drainage: well (- moderately well)
Rooting Depth (cm): 40 (20-70)
Humus Thickness (cm): 11 (4-22)
Humus Form: Hemimor and Mormoder
pH Humus: 4.2
pH Mineral: 3.8

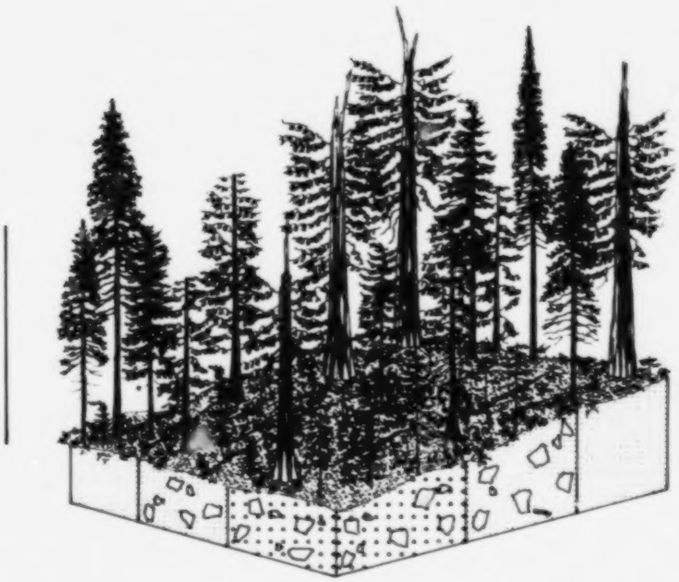
COMMENTS:

Finer-textured soils are in shedding positions.

ICHk/06 DEVIL'S CLUB - OAK FERN

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/06; Oplopanax - Gymnocarpium; ICHk: Devil's club - oak fern association.



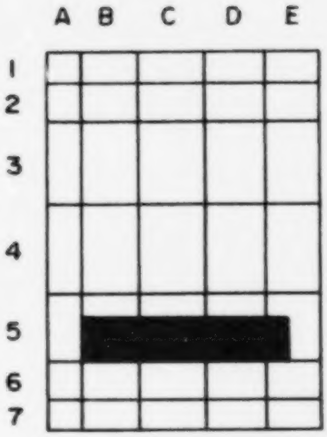
ECOLOGICAL MOISTURE REGIME: subhygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: lower - level
Seepage Water: may be present
Parent Material: two phases: one lacustrine; the other fluvial, colluvial or morainal

DISTRIBUTION: common



ICHk/06 DEVIL'S CLUB - OAK FERN

VEGETATION:

Tree Layer: 65% cover

Thuja plicata	(western redcedar)
Tsuga heterophylla	(western hemlock)
Picea glauca x engelmannii	(hybrid white spruce)
[Abies lasiocarpa	(subalpine fir)]

Shrub Layer: 75% cover

Thuja plicata		)- regeneration
Tsuga heterophylla		)
[Abies lasiocarpa]		)
[Betula papyrifera	(paper birch)]	)
[Picea glauca x engelmannii]		)
Oplopanax horridus	(devil's club)	- high cover
Ribes lacustre	(black gooseberry)	
[Acer glabrum	(Douglas maple)]	
[Vaccinium ovalifolium	(oval-leaved blueberry)]	

Herb Layer: 75% cover

Gymnocarpium dryopteris	(oak fern)	
Dryopteris assimilis	(spiny wood fern)	
Tiarella unifoliata	(one-leaved foamflower)	
Streptopus roseus	(rosy twistedstalk)	
Streptopus amplexifolius	(clasping twistedstalk)	
Cornus canadensis	(bunchberry)	
Rubus pedatus	(five-leaved bramble)	
Tiarella trifoliata	(three-leaved foamflower)	
Clintonia uniflora	(queen's cup)	
Goodyera oblongifolia	(rattlesnake-plantain)	
Smilacina racemosa	(false Solomon's-seal)	
[Galium triflorum	(sweet-scented bedstraw)]	
[Circaea alpina	(enchanter's nightshade)]	)- good indicators,
[Athyrium filix-femina	(lady fern)]	) if present
[Aralia nudicaulis	(wild sarsaparilla)]	
[Streptopus streptopoides	(small twistedstalk)]	
[Goodyera repens	(dwarf rattlesnake orchid)]	

Moss Layer: 75% cover

Hylocomium splendens	(step moss)
Mnium spp.	(leafy mosses)
Ptilium crista-castrensis	(knight's plume)
[Rhytidiadelphus triquetrus	(electrified cat's-tail)]
[Pleurozium schreberi	(red-stemmed feather moss)]

ICHk/06 DEVIL'S CLUB - OAK FERN

SOIL AND SITE:

ICHk/06(a) COARSE-TEXTURED PHASE

Moisture Regime: subhygric
Nutrient Regime: submesotrophic - mesotrophic
Slope Gradient (%): 12 (0-54; usually less than 10)
Parent Material: fluvial, colluvial and morainal
Soil Classification: Humo-Ferric Podzol (often Gleyed)
Soil Texture: medium - coarse
Coarse Fragment (%): 38 (0-65; usually greater than 20)
Soil Drainage: moderately well - imperfectly
Rooting Depth (cm): 33 (20-50)
Humus Thickness (cm): 12 (5-22)
Humus Form: Humimor, Mormoder, and Leptomoder
pH Humus: 4.9
pH Mineral: 4.6

ICHk/06(b) FINE-TEXTURED PHASE

Moisture Regime: subhygric
Nutrient Regime: mesotrophic - permesotrophic
Slope Gradient (%): 18 (0-30)
Parent Material: lacustrine
Soil Classification: Gleyed Brunisolic and Podzolic Gray Luvisol
Soil Texture: medium - fine
Coarse Fragment (%): usually zero (always less than 10)
Soil Drainage: imperfectly

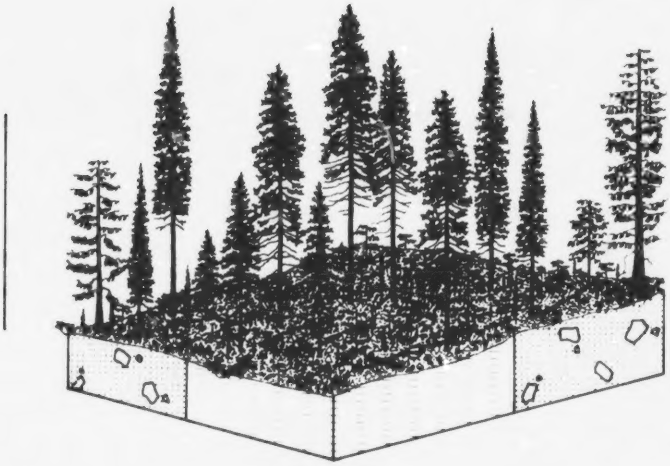
COMMENTS:

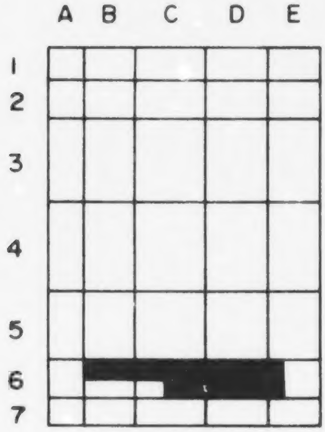
Limited data for fine-textured phase.

ICHk/07 BLACK TWINBERRY - HORSETAIL

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/07; Lonicera - Equisetum; ICHk: Black twinberry - horsetail association.





ECOLOGICAL MOISTURE REGIME: hygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: lower - level
Seepage Water: often present
Parent Material: two phases: lacustrine, and fluvial

DISTRIBUTION: uncommon

ICHk/07 BLACK TWINBERRY - HORSETAIL

VEGETATION:

Tree Layer: 70% cover

Picea glauca x *engelmannii*	(hybrid white spruce)	- dominant
Abies lasiocarpa	(subalpine fir)	
[*Thuja plicata*	(western redcedar)]	
[*Tsuga heterophylla*	(western hemlock)]	
[*Populus balsamifera*	(cottonwood)]	
[*Betula papyrifera*	(paper birch)]	

Shrub Layer: 60% cover

Thuja plicata		)- regeneration
Abies lasiocarpa		)
Picea glauca x *engelmannii*		)
[*Tsuga heterophylla*]		)
Oplopanax horridus	(devil's club)	- dominant
Lonicera involucrata	(black twinberry)	
Ribes lacustre	(black gooseberry)	
Rubus parviflorus	(thimbleberry)	
Viburnum edule	(highbush-cranberry)	
[*Rubus idaeus*	(red raspberry)]	
[*Cornus sericea*	(red-osier dogwood)]	
[*Sambucus racemosa*	(red elderberry)]	

Herb Layer: 65% cover; well-developed; high diversity

Equisetum arvense	(common horsetail)	- good indicator
Equisetum sylvaticum	(wood horsetail)	
Equisetum pratense	(meadow horsetail)	- good indicator
Athyrium filix-femina	(lady fern)	
Gymnocarpium dryopteris	(oak fern)	
Dryopteris assimilis	(spiny wood fern)	
Aralia nudicaulis	(wild sarsaparilla)	
Rubus pubescens	(trailing raspberry)	
Mitella nuda	(common mitrewort)	
Circaea alpina	(enchanter's nightshade)	
Cornus canadensis	(bunchberry)	
Galium triflorum	(sweet-scented bedstraw)	
Tiarella unifoliata	(one-leaved foamflower)	
Lycopodium annotinum	(stiff club-moss)	
Rubus pedatus	(five-leaved bramble)	
Streptopus roseus	(rosy twistedstalk)	
Streptopus amplexifolius	(clasping twistedstalk)	

Moss Layer: 80% cover

Rhytidiadelphus triquetrus	(electrified cat's-tail)
Hylocomium splendens	(step moss)
Mnium spp.	(leafy mosses)
Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)

ICHk/07 BLACK TWINBERRY - HORSETAIL

SOIL AND SITE:

ICHk/07(a) FLUVIAL PHASE

Moisture Regime:	hygric
Nutrient Regime:	submesotrophic - mesotrophic
Slope Gradient (%):	0
Parent Material:	fluvial
Soil Classification:	Gleysol and gleyed subgroups
Soil Texture:	medium - coarse
Coarse Fragment (%):	0 (on limited data)
Soil Drainage:	imperfectly - poorly
Seepage Water:	may be present; fluctuating water table
Rooting Depth (cm):	32 (25-40)
Humus Thickness (cm):	9 (7-11)
Humus Form:	Moder and Mull
pH Humus:	5.1
pH Mineral:	5.1

ICHk/07(b) LACUSTRINE PHASE

Moisture Regime:	hygric
Nutrient Regime:	permesotrophic - subeutrophic
Slope Gradient (%):	10 (0-22)
Parent Material:	lacustrine
Soil Classification:	Gleysol and Gleyed Gray Luvisol
Soil Texture:	moderately fine - fine
Coarse Fragment (%):	0
Soil Drainage:	imperfectly - poorly
Seepage Water:	usually present
Rooting Depth (cm):	22 (15-30)
Humus Thickness (cm):	15 (9-22)
Humus Form:	Mormoder and Leptomoder
pH Mineral:	5.1

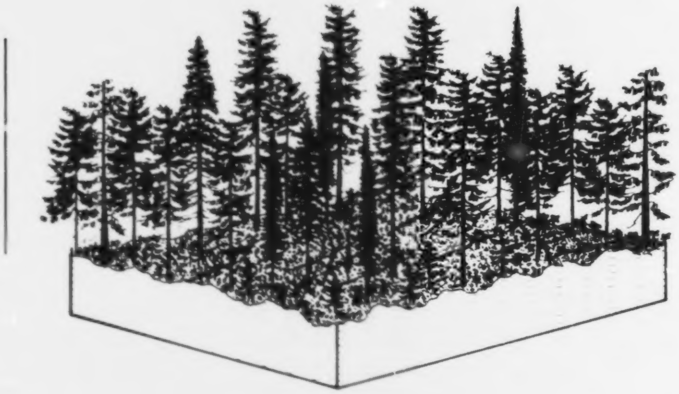
COMMENTS:

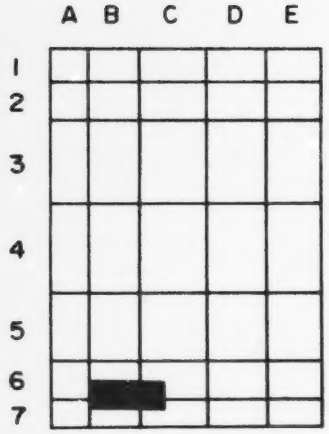
These ecosystems usually occur near boundaries with the SBSg subzone.

ICHk/08 HEMLOCK - HORSETAIL

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/08; Tsuga - Equisetum; ICHk: Hemlock - horsetail association.





ECOLOGICAL MOISTURE REGIME: hygric - subhydric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 1 (0-5)
Slope Position: level
Parent Material: lacustrine
Seepage Water: present

DISTRIBUTION: common

ICHk/08 HEMLOCK - HORSETAIL

VEGETATION:

Tree Layer: 65% cover

Tsuga heterophylla	(western hemlock)	- dominant
Picea glauca x *engelmannii*	(hybrid white spruce)	
Abies lasiocarpa	(subalpine fir)	
[*Thuja plicata*	(western redcedar)]	
[*Betula papyrifera*	(paper birch)]	

Shrub Layer: 40% cover; mostly hemlock regeneration

Tsuga heterophylla		)- regeneration
Abies lasiocarpa		)
Vaccinium ovalifolium	(oval-leaved blueberry)	
Vaccinium membranaceum	(black huckleberry)	
Menziesia ferruginea	(false azalea)	
[*Oplopanax horridus*	(devil's club)]	- low cover

Herb Layer: 60% cover

Equisetum sylvaticum	(wood horsetail)	- dominant
Rubus pedatus	(five-leaved bramble)	
Gymnocarpium dryopteris	(oak fern)	
Cornus canadensis	(bunchberry)	
Athyrium filix-femina	(lady fern)	
Dryopteris assimilis	(spiny wood fern)	
Streptopus roseus	(rosy twistedstalk)	
Streptopus amplexifolius	(clasping twistedstalk)	
[*Linnaea borealis*	(twinflower)]	
[*Tiarella unifoliata*	(one-leaved foamflower)]	
[*Moneses uniflora*	(single delight)	
[*Listera cordata*	(heart-leaved twayblade)	

Moss Layer: 95% cover

Sphagnum girgensohnii	(common green sphagnum)	- good indicator
Hylocomium splendens	(step moss)	
Ptilium crista-castrensis	(knight's plume)	
Pleurozium schreberi	(red-stemmed feather moss)	

ICHk/08 HEMLOCK - HORSETAIL

SOIL AND SITE:

Soil Classification: Gleysol (Humic, Luvic and Orthic)
Soil Texture: moderately fine - fine
Coarse Fragment (%): 0-16; usually zero
Soil Drainage: poorly - very poorly
Rooting Depth (cm): 13 (0-23)
Humus Thickness (cm): 14 (5-23)
Humus Form: commonly Histomor and Hemihydromor
pH Humus: 3.7
pH Mineral: 4.1

COMMENTS:

This association has been divided into two subassociations. The ICHk/08.1 is slightly better drained than the ICHk/08.2. This is reflected in the better productivity of the stands in the ICHk/08.1.

Humus form is usually a wetland type, sometimes overlying Ah. Wet, poorly aerated and cold soils make nutrient regime poorer than fine texture may indicate.

ICHk/08.1 HEMLOCK - HORSETAIL - STEP MOSS

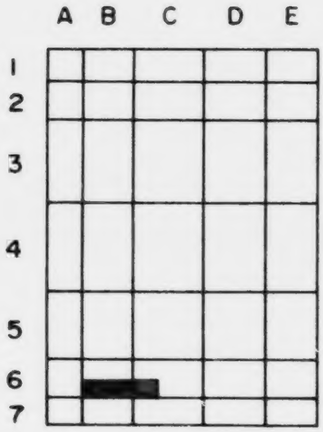
BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/08.1; Tsuga - Equisetum - Hylocomium; ICHk: Hemlock - horsetail - step moss subassociation.

ECOLOGICAL MOISTURE REGIME: hygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES: same as ICHk/08



VEGETATION: same as ICHk/08 EXCEPT:

Tree Layer:		
Thuja plicata	(western redcedar)	- higher cover than ICHk/08.2
Shrub Layer:		
Oplopanax horridus	(devil's club)	- higher cover than ICHk/08.2
[Vaccinium membranaceum	(black huckleberry)]	)-lower constancy than
[Menziesia ferruginea	(false azalea)]	) ICHk/08.2
Herb Layer:		
Rubus pedatus	(five-leaved bramble)	- higher cover than ICHk/08.2
Moss Layer:		
Hylocomium splendens	(step moss)	)- higher cover than
Ptilium crista-castrensis	(knight's plume)	) ICHk/08.2
Pleurozium schreberi	(red-stemmed feather moss)	)
Sphagnum girgensohnii	(common green sphagnum)	- lower cover than ICHk/08.2

ICHk/08.1 HEMLOCK - HORSETAIL - STEP MOSS

SOIL AND SITE: same as ICHk/08 EXCEPT:

Soil Drainage: poorly
Humus Thickness (cm): 10 (5-18)
Humus Form: Hemihydromor and Histomor (often on same site)

COMMENTS:

Better drainage than ICHk/08.2 results in better productivity.

ICHk/08.2 HEMLOCK - HORSETAIL - SPHAGNUM

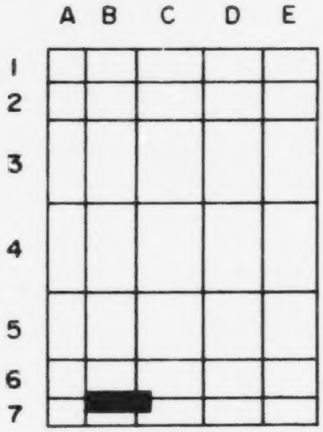
BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/08.2; *Tsuga* - *Equisetum* - *Sphagnum*; ICHk: Hemlock - horsetail - sphagnum subassociation.

ECOLOGICAL MOISTURE REGIME: hygric - subhydric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES: same as ICHk/08



VEGETATION: *same* as ICHk/08 EXCEPT:

Tree Layer:

[*Thuja plicata*	(western redcedar)]	- rarely present

Shrub Layer:

[*Thuja plicata*		- present, with low constancy

Moss Layer:

Sphagnum girgensohnii	(common green sphagnum)	)- dominant over
Sphagnum squarrosum		) feathermosses
Sphagnum capillaceum	(common red sphagnum)	)

SOIL AND SITE: same as ICHk/08 EXCEPT:

Soil Drainage:	poorly - very poorly
Humus Thickness (cm):	15 (8-23)
Humus Form:	Histomor

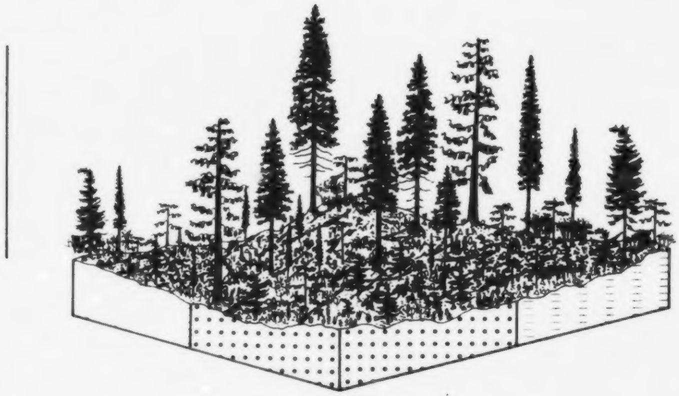
COMMENTS:

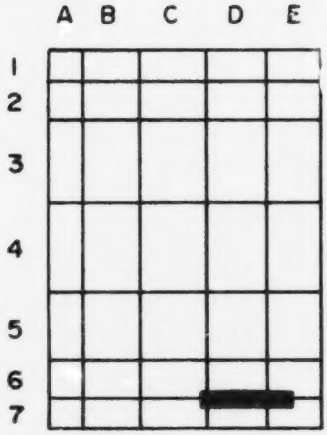
Unproductive sites for forestry.

ICHk/09 MOUNTAIN ALDER - SKUNK CABBAGE

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/09; *Alnus* (*incana* ssp. *tenuifolia*) - *Lysichiton*; ICHk: Mountain alder - skunk cabbage association.





ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: permesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient (%): 1
Slope Position: depression
Seepage Water: present; water table near surface

DISTRIBUTION: rare

ICHk/09 MOUNTAIN ALDER - SKUNK CABBAGE

VEGETATION:

Tree Layer: 30% cover; very uneven height distribution

Thuja plicata	(western redcedar)	
Tsuga heterophylla	(western hemlock)	
Picea glauca x *engelmannii*	(hybrid white spruce)	
Abies lasiocarpa	(subalpine fir)	

Shrub Layer: 50% cover; mostly regeneration

Thuja plicata		)- regeneration
Tsuga heterophylla		)
Abies lasiocarpa		)
Picea glauca x *engelmannii*		)
Alnus incana ssp. *tenuifolia*	(mountain alder)	
Lonicera involucrata	(black twinberry)	
Menziesia ferruginea	(false azalea)	
Ribes lacustre	(black gooseberry)	
Viburnum edule	(highbush-cranberry)	
[*Oplopanax horridus*	(devil's club)]	

Herb Layer: 50% cover

Glyceria elata	(tall mannagrass)	
Lysichiton americanum	(skunk cabbage)	- good indicator
Thelypteris phegopteris	(beech fern)	
Carex disperma	(soft-leaved sedge)	
Equisetum arvense	(common horsetail)	
Equisetum sylvaticum	(wood horsetail)	
Equisetum pratense	(meadow horsetail)	
[*Rubus pubescens*	(trailing raspberry)]	
[*Athyrium filix-femina*	(lady fern)]	
[*Gymnocarpium dryopteris*	(oak fern)]	
[*Mitella nuda*	(common mitrewort)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	

Moss Layer: 95% cover

Mnium punctatum var. *elatum*		- dominant
Rhytidiadelphus triquetrus	(electrified cat's tail)	- dry microsites
Calliergon spp.		
Drepanocladus spp.		

SOIL AND SITE:

Parent Material:	fluvial and lacustrine
Soil Classification:	Gleysol
Soil Texture:	variable
Soil Drainage:	very poorly
Rooting Depth (cm):	5
Humus Thickness (cm):	10
Humus Form:	Moder and Mull

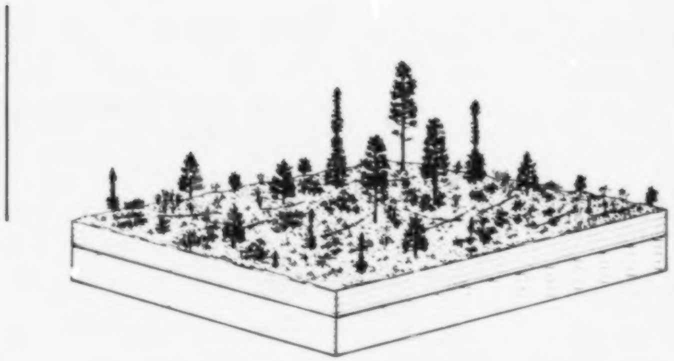
COMMENTS:

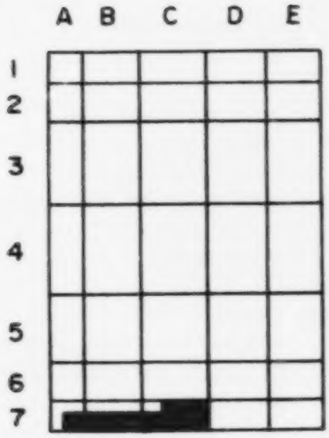
Limited data as ecosystem is rare. Occurs in narrow drainage channels.

ICHk/10 PINE - SPHAGNUM

BIOGEOCLIMATIC UNIT: ICHk

ECOSYSTEM UNIT: ICHk/10; Pinus - Sphagnum; ICHk: Pine - sphagnum association.





ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: level - depression
Water Table: close to surface

DISTRIBUTION: uncommon

ICHk/10 PINE - SPHAGNUM

VEGETATION:

Tree Layer: 10% cover

Picea mariana	(black spruce)
Pinus contorta	(lodgepole pine)

Shrub Layer: 30% cover

Pinus contorta		)- regeneration
Picea mariana		)
Tsuga heterophylla	(western hemlock)	)
Ledum groenlandicum	(Labrador tea)	
Betula glandulosa	(scrub birch)	
Kalmia microphylla ssp. *occidentalis*	(bog-laurel)	

Herb Layer: 50% cover

Carex pauciflora	(few-flowered sedge)
Carex sitchensis	(Sitka sedge)
Carex spp.	(sedges)
Vaccinium oxycoccos	(bog cranberry)
Andromeda polifolia	(bog rosemary)
Eriophorum chamissonis	(Chamisso's cotton-grass)
Eriophorum angustifolium	(narrow-leaved cotton-grass)
Menyanthes trifoliata	(buckbean)
[*Drosera rotundifolia*	(round-leaved sundew)]

Moss Layer: 95% cover

Sphagnum spp.	(sphagnums)	
[*Pleurozium schreberi*	(red-stemmed feather moss)]	- drier microsites

SOIL AND SITE:

Slope Gradient (%):	0
Parent Material:	lacustrine, organic and organic veneer over lacustrine
Soil Classification:	Mesisol, Fibrisol and peaty-phase Gleysol
Soil Texture:	fibric and mesic
Soil Drainage:	very poorly
Humus Thickness (cm):	greater than 40
Humus Form:	Histomor (and Histomoder)
pH Humus:	4.4

COMMENTS:

These bog ecosystems are quite variable as they differ somewhat in the depth of organic material and the "richness" of the water "moving" through the site. Most of the bogs are in shallow depressions over lacustrine material.

6.3.1 Discussion

Ten associations have been described in the ICHk subzone. The ranges of moisture and nutrient regimes occuped by these associations are represented in Figure 6.5.

The generalized position of each association within a catchment area is represented by Figure 6.6. Steep slopes and subdued topography are both common in this subzone.

The most common association in this subzone is the ICHk/01, the mesic oak fern association. This association plus the ICHk/06 cover between 50% and 70% of the subzone. The ICHk/02, ICHk/04, and ICHk/10 are all rare, and together probably cover less than 2% of the subzone.

Seral stands are rare; but when they occur, they are usually mixed stands of trembling aspen, paper birch, western redcedar, western hemlock and Douglas-fir.

As with the ICHj subzone, dense stands of western hemlock occur in the ICHk subzone. Understory vegetation may be poorly developed and may not truly reflect the moisture regime of the site. These sites are best classified using soil and site factors alone.

6.4 Ecosystem Units of the ICHf

TABLE 6.4 Ecosystem (biogeocoenotic) units of the Very Wet Northern Interior Cedar - Hemlock subzone (ICHf)

Code	Ecosystem Unit	Scientific name	Common name
ICHf/01	association	*Oplopanax* - *Gymnocarpium*	Devil's club - oak fern
ICHf/01(a)	phase		Devil's club - oak fern, coarse-textured phase
ICHf/01(b)	phase		Devil's club - oak fern, fine-textured phase
ICHf/02	association	*Tsuga* - Vaccinium (membranaceum)	Hemlock - black huckleberry
ICHf/03	association	*Chimaphila* - *Hylocomium*	Prince's pine - step moss
ICHf/04	association	*Gymnocarpium* - *Hylocomium*	Oak fern - step moss
ICHf/05	association	*Oplopanax* - *Matteucia*	Devil's club - ostrich fern
ICHf/06	association	*Alnus(incana* ssp. - *tenuifolia)* - *Lysichiton*	Mountain alder - skunk cabbage
ICHf/07	association	*Picea* (*mariana*) - *Sphagnum*	Black spruce - sphagnum

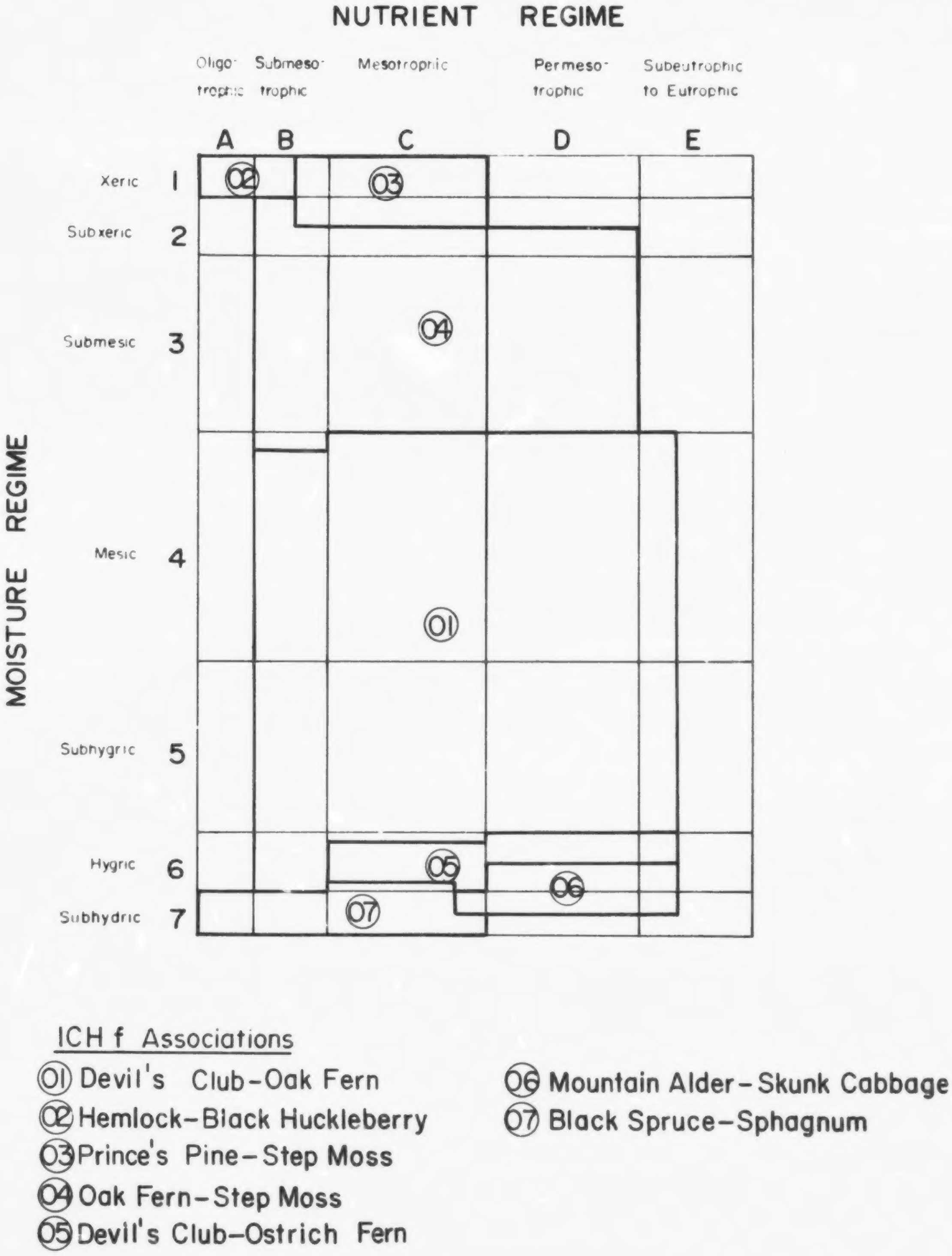

NUTRIENT REGIME
Oligotrophic
Submesotrophic
Mesotrophic
Permesotrophic
Subeutrophic to Eutrophic
A
B
C
D
E
MOISTURE REGIME
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02
03
04
01
05
06
07
ICH f Associations
01 Devil's Club-Oak Fern
02 Hemlock-Black Huckleberry
03 Prince's Pine-Step Moss
04 Oak Fern-Step Moss
05 Devil's Club-Ostrich Fern
06 Mountain Alder-Skunk Cabbage
07 Black Spruce-Sphagnum

FIG. 6.7 Edatopic grid of ecological moisture and nutrient regime for the ICHf subzone.

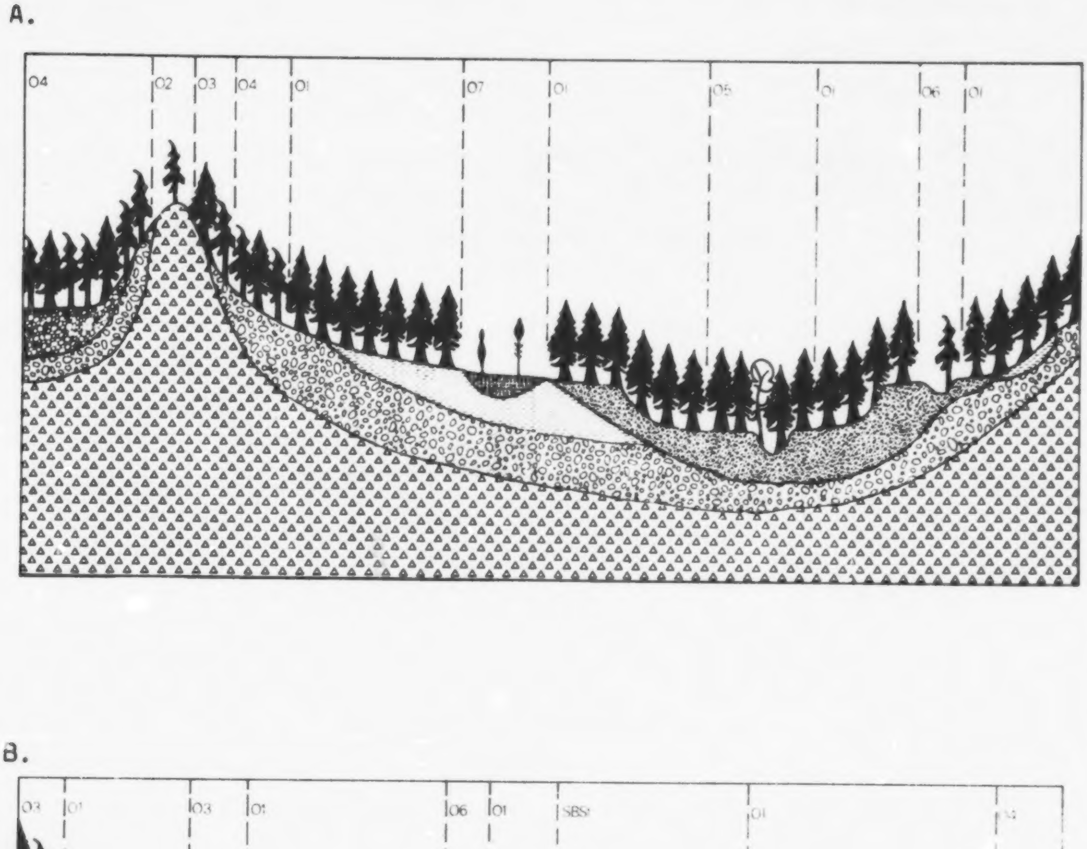
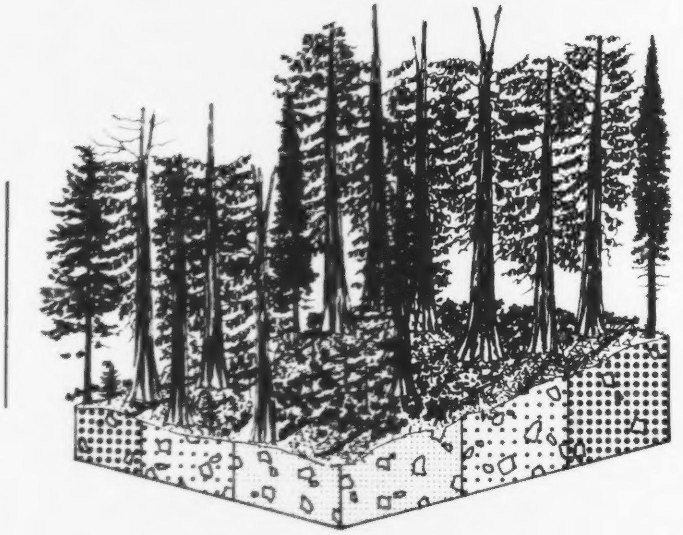

A.
O4
O2
O3
O4
O1
O7
O1
O5
O1
O6
O1
B.
O3
O1
O3
O1
O6
O1
SBS
O1

FIG. 6.8. Toposequence of associations in the ICHf subzone.
A: Subdued topography; B: Steep slopes.

ICHf/01 DEVIL'S CLUB - OAK FERN

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/01; *Oplopanax* - *Gymnocarpium*; ICHf: Devil's club - oak fern association.



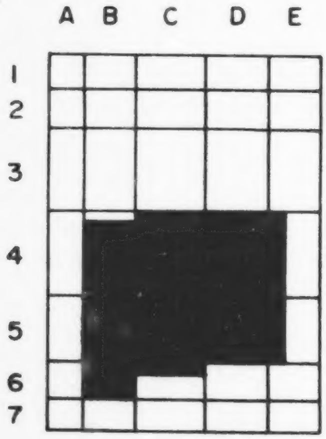
ECOLOGICAL MOISTURE REGIME: mesic - subhygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: usually mid - lower
Soil Drainage: well - moderately well, (occasionally imperfectly)
Soil Texture: two phases: medium- - coarse-textured; and fine-textured

DISTRIBUTION: very common



ICHf/01 DEVIL'S CLUB - OAK FERN

VEGETATION:

Tree Layer: 60% cover

Thuja plicata	(western redcedar)	- dominant
[Tsuga heterophylla	(western hemlock)]	
[Picea glauca x engelmannii	(hybrid white spruce)]	
[Abies lasiocarpa	(subalpine fir)]	

Shrub Layer: 55% cover

Thuja plicata		)- regeneration
Tsuga heterophylla		)
[Picea glauca x engelmannii]		)
[Abies lasiocarpa]		)
Oplopanax horridus	(devil's club)	- mod. to high cover and dominant
Rubus parviflorus	(thimbleberry)	
Ribes lacustre	(black gooseberry)	
[Acer glabrum	(Douglas maple)]	
[Vaccinium ovalifolium	(oval-leaved blueberry)]	

Herb Layer: 65% cover

Gymnocarpium dryopteris	(oak fern)	)- dominants
Athyrium filix-femina	(lady fern)	)
Tiarella unifoliata	(one-leaved foamflower)	
Rubus pedatus	(five-leaved bramble)	
Cornus canadensis	(bunchberry)	
Dryopteris assimilis	(spiny wood fern)	
Circaea alpina	(enchanter's nightshade)	
Streptopus roseus	(rosy twistedstalk)	
Smilacina racemosa	(false Solomon's-seal)	
Galium triflorum	(sweet-scented bedstraw)	
Clintonia uniflora	(queen's cup)	
[Streptopus amplexifolius	(clasping twistedstalk)]	
[Goodyera oblongifolia	(rattlesnake-plantain)]	
[Viola spp.	(violets)]	
[Tiarella trifoliata	(three-leaved foamflower)]	
[Actaea rubra	(baneberry)]	

Moss Layer: 25% cover; poorly developed

Mnium spp.	(leafy mosses)	)- dominant
Brachythecium spp.		
[Hylocomium splendens	(step moss)]	)- occasionally present
[Ptilium crista-castrensis	(knight's plume)]	) with mod. cover
[Rhytidiadelphus triquetrus	(electrified cats'-tail)]	)
[Pleurozium schreberi	(red-stemmed feather moss)]	)

ICHf/01 DEVIL'S CLUB - OAK FERN

SOIL AND SITE:

ICHf/01(a) COARSE-TEXTURED PHASE

Moisture Regime: mesic (- subhygric)
Nutrient Regime: submesotrophic - subeutrophic
Slope Gradient (%): 13 (0-26)
Parent Material: variable; not fine-textured lacustrine
Soil Classification: Humo Ferric Podzol, Brunisolic and Podzolic Gray Luvisol, and gleyed subgroups
Soil Texture: medium - coarse, or moderately fine with coarse fragments
Coarse Fragment (%): 43 (0-95)
Soil Drainage: well - imperfectly
Seepage Water: occasionally present
Rooting Depth(cm): 33 (10-65)
Humus Thickness(cm): 10 (4-44)
Humus Form: usually Mormoder and Leptomoder
pH Mineral: 4.7

ICHf/01(b) FINE-TEXTURED PHASE

Moisture Regime: (mesic -) subhygric
Nutrient Regime: mesotrophic - permesotrophic
Slope Gradient (%): 31 (0-50)
Parent Material: lacustrine
Soil Classification: Gleyed Brunisolic Grey Luvisol
Soil Texture: medium - moderately fine (fine at depth)
Coarse Fragment (%): 0
Soil Drainage: (moderately well -) imperfectly
Seepage Water: may be present
Rooting Depth(cm): 36 (25-50)
Humus Thickness(cm): 14 (7-27)
Humus Form: Humihemimor, Leptomoder and Mull
pH Mineral: 4.4

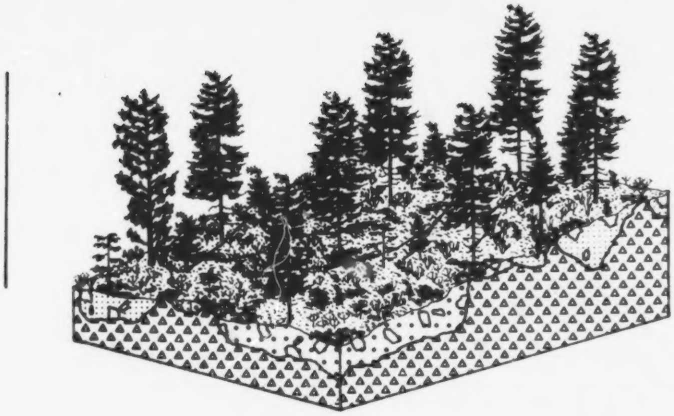
COMMENTS:

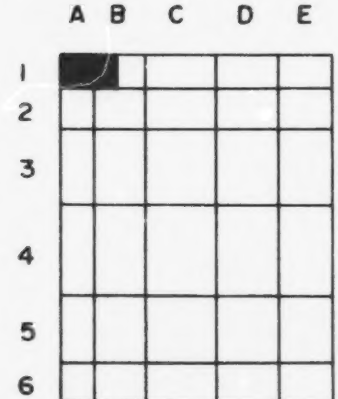
The fine-textured phase (ICHf/01(b)) is not as common as the ICHf/01(a), as lacustrine deposits are not extensive in this subzone. The lacustrine soils will be cold and slow to warm in the spring. They will also be subject to slumping and be easily compacted.

ICHf/02 HEMLOCK - BLACK HUCKLEBERRY

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/02; Tsuga - Vaccinium (membranaceum); ICHf: Hemlock - black huckleberry association.





ECOLOGICAL MOISTURE REGIME: xeric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: upper - crest
Parent Material: very shallow veneer over bedrock

DISTRIBUTION: rare

ICHf/02 HEMLOCK - BLACK HUCKLEBERRY

VEGETATION:

Tree Layer: 25% cover

Tsuga heterophylla	(western hemlock)	
[*Pseudotsuga menziesii*	(Douglas-fir)]	)- seral

Shrub Layer: 30% cover; mostly regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata	(western redcedar)	)
Vaccinium membranaceum	(black huckleberry)	
[*Sorbus sitchensis*	(Sitka mountain-ash)]	
[*Rhododendron albiflorum*	(white-flowered rhododendron)]	
[*Vaccinium ovalifolium*	(oval-leaved blueberry)]	

Herb Layer: 10% cover

Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
[*Orthilia secunda*	(one-sided wintergreen)]
[*Streptopus streptopoides*	(small twistedstalk)]
[*Moneses uniflora*	(single delight)]

Moss Layer: 25% cover; poorly developed

Pleurozium schreberi	(red-stemmed feather moss)
Barbilophozia floerkei	
Dicranum pallidisetum	
Hylocomium splendens	(step moss)
[*Nephroma arcticum*]	
[*Ptilium crista-castrensis*	(knight's plume)]
[*Peltigera aphthosa*]	
[*Barbilophozia lycopodioides*	(common leafy liverwort)]
[*Cladonia* spp.]	

ICHf/02 HEMLOCK - BLACK HUCKLEBERRY

SOIL AND SITE:

Slope Gradient (%):	20 (16-27)
Soil Classification:	Dystric Brunisol and Regosol
Soil Texture:	medium - coarse
Coarse Fragment (%):	52 (15-98)
Soil Drainage:	rapidly - well
Rooting Depth(cm):	12 (7-22)
Humus Thickness(cm):	5 (3-6)
Humus Form:	Xeromor

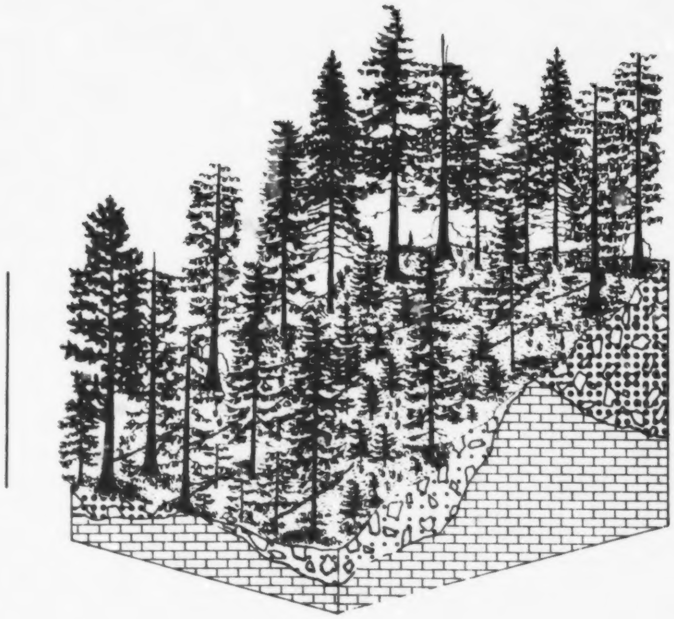
COMMENTS:

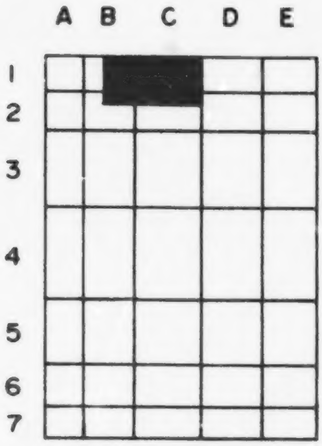
This ecosystem is found on very shallow soils over rock outcrops. Usually a moderate cover of rocks and stones on surface.

ICHf/03 PRINCE'S PINE - STEP MOSS

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/03; *Chimaphila* - *Hylocomium*; ICHf: Prince's - pine - step moss association.





ECOLOGICAL MOISTURE REGIME: xeric - subxeric

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: upper - crest
Parent Material: colluvial or morainal veneer over bedrock
Soil Texture: moderately coarse - coarse

DISTRIBUTION: uncommon

ICHf/03 PRINCE'S PINE - STEP MOSS

VEGETATION:

Tree Layer: 60% cover

Thuja plicata	(western redcedar)	)- dominants
Tsuga heterophylla	(western hemlock)	)
Pseudotsuga menziesii	(Douglas-fir)	- veterans; seral
[Picea glauca x engelmannii	(hybrid white spruce)]	
[Abies lasiocarpa	(subalpine fir)]	

Shrub Layer: 30% cover; mostly regeneration

Tsuga heterophylla		)- regeneration
Thuja plicata		)
Abies lasiocarpa		)
[Oplopanax horridus	(devil's club)]	)- very low cover
[Acer glabrum	(Douglas maple)]	)
[Ribes lacustre	(black gooseberry)]	)
[Vaccinium membranaceum	(black huckleberry)]	)

Herb Layer: 20% cover

Cornus canadensis	(bunchberry)	
Chimaphila umbellata	(prince's pine)	- good indicator
Clintonia uniflora	(queen's cup)	
Orthilia secunda	(one-sided wintergreen)	
[Goodyera oblongifolia	(rattlesnake-plantain)]	
[Tiarella unifoliata	(one-leaved foamflower)]	
[Smilacina racemosa	(false Solomon's-seal)]	
[Aralia nudicaulis	(wild sarsaparilla)]	
[Rubus pedatus	(five-leaved bramble)]	)- occasionally present with mod. cover
[Gymnocarpium dryopteris	(oak fern)]	)

Moss Layer: 80% cover

Hylocomium splendens	(step moss)	- dominant
Rhytidiadelphus triquetrus	(electrified cat's-tail)	
Pleurozium schreberi	(red-stemmed feather moss)	
Ptilium crista-castrensis	(knight's plume)	
[Peltigera aphthosa]		
[Dicranum scoparium	(broom moss)]	

ICHf/03 PRINCE'S PINE - STEP MOSS

SOIL AND SITE:

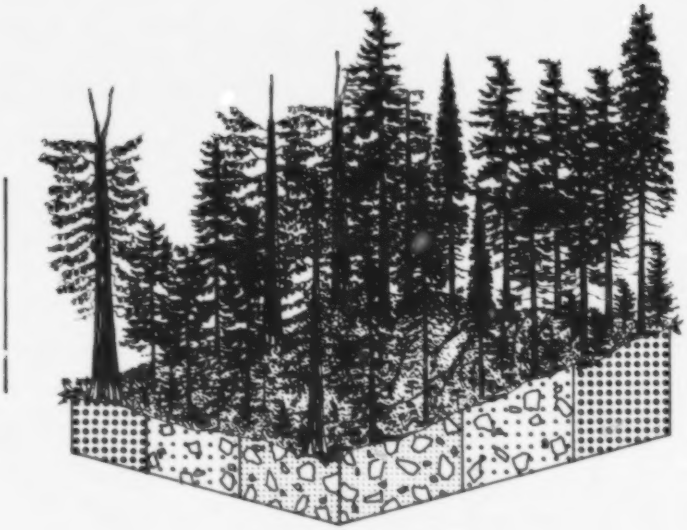
Slope Gradient (%): 41 (0-76)
Soil Classification: variable (Podzols most common)
Coarse Fragment (%): 73 (43-91)
Soil Drainage: rapidly - well
Rooting Depth(cm): 37 (25-53)
Humus Thickness(cm): 14 (8-30)
Humus Form: Humimor and Mormoder
pH Mineral: 5.2 (3.8-6.5)

COMMENTS: The soils are shallow (25-50 cm), but deeper than ICHf/02. Moderate to low cover of cobbles and stones on surface of site.

ICHf/04 OAK FERN - STEP MOSS

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/04; Gymnocarpium - Hylocomium; ICHf: Oak fern - step moss association.



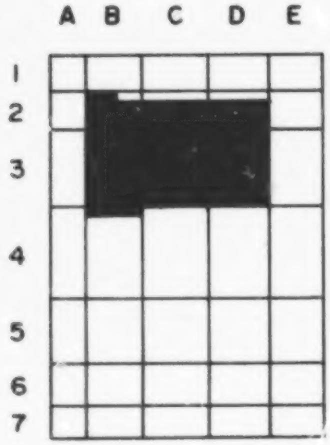
ECOLOGICAL MOISTURE REGIME: (subxeric -) submesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic - mesotrophic (- permesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Soil Texture: medium- - coarse-textured
Soil Drainage: well - moderately well

DISTRIBUTION: common



ICHf/04 OAK FERN - STEP MOSS

VEGETATION:

Tree Layer: 70% cover

Tsuga heterophylla	(western hemlock)	
Thuja plicata	(western redcedar)	
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Abies lasiocarpa*	(subalpine fir)]	
[*Pseudotsuga menziesii*	(Douglas-fir)]	- sometimes present as veterans

Shrub Layer: 30% cover

Tsuga heterophylla		)- regeneration
Thuja plicata		)
[*Abies lasiocarpa*]		)
Oplopanax horridus	(devil's club)	- usually low cover
Vaccinium ovalifolium	(oval-leaved blueberry)	
Vaccinium membranaceum	(black huckleberry)	
[*Ribes lacustre*	(black gooseberry)]	

Herb Layer: 60% cover

Gymnocarpium dryopteris	(oak fern)	)- dominants
Rubus pedatus	(five-leaved bramble)	)
Cornus canadensis	(bunchberry)	)
Tiarella unifoliata	(one-leaved foamflower)	
Tiarella trifoliata	(three-leaved foamflower)	
Streptopus roseus	(rosy twistedstalk)	
Dryopteris assimilis	(spiny wood fern)	- variable cover
Clintonia uniflora	(queen's cup)	
Aralia nudicaulis	(wild sarsaparilla)	- variable cover
[*Lycopodium annotinum*	(stiff club-moss)]	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	
[*Moneses uniflora*	(single delight)]	

Moss Layer: 90% cover

Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feather moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
[*Brachythecium* spp.]	

ICHf/04 OAK FERN - STEP MOSS

SOIL AND SITE:

Slope Gradient (%):	16 (0-51)
Slope Position:	variable
Parent Material:	variable (fluvial, glaciofluvial, morainal and colluvial)
Soil Classification:	commonly Humo-Ferric Podzol (also Brunisolic Gray Luvisol)
Coarse Fragment (%):	36 (0-87)
Rooting Depth(cm):	25 (20-70)
Humus Thickness(cm):	7 (4-15)
Humus Form:	Mormoder and Leptomoder
pH Humus:	4.6
pH Mineral:	4.2

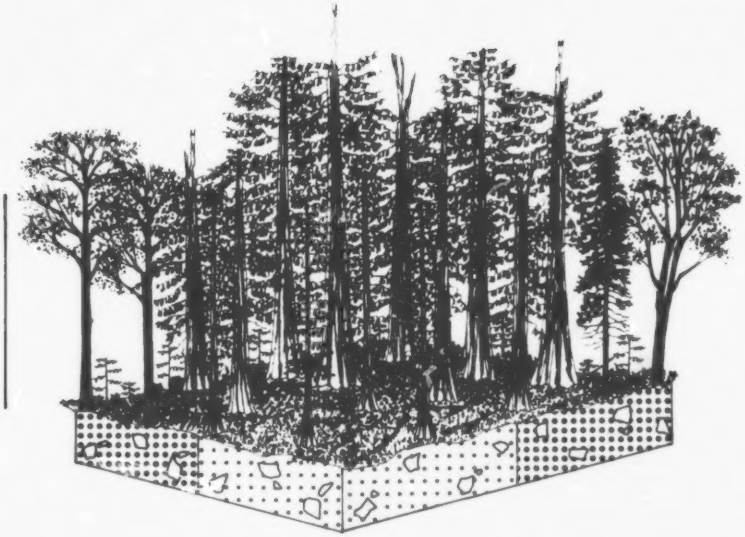
COMMENTS:

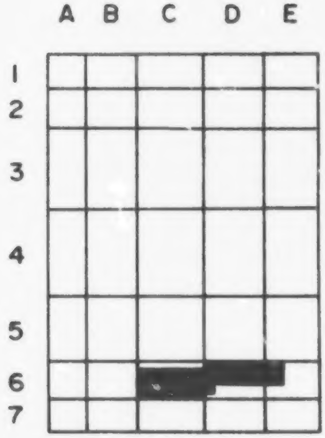
Medium-textured soils usually compensated by other factors (steep slope, coarse fragments, shallow depth of soil).

ICHf/05 DEVIL'S CLUB - OSTRICH FERN

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/05; Oplopanax - Matteucia; ICHf: Devils' club - ostrich fern association.





ECOLOGICAL MOISTURE REGIME: hygric

NUTRIENT REGIME: mesotrophic - permesotrophic
(- subeutrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: lower - level
Parent Material: fluvial
Soil Texture: medium - coarse

DISTRIBUTION: rare

ICHf/05 DEVIL'S CLUB - OSTRICH FERN

VEGETATION:

Tree Layer: 70% cover

Thuja plicata	(western redcedar)	- dominant
[*Populus balsamifera* ssp. *trichocarpa*	(black cottonwood)]	- seral
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	
[*Betula papyrifera*	(paper birch)]	- seral
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 80% cover

Thuja plicata		)- regeneration
[*Picea glauca* x *engelmannii*]		)
[*Abies lasiocarpa*]		)
Oplopanax horridus	(devil's club)	- high cover
Rubus parviflorus	(thimbleberry)	- mod. cover
Ribes lacustre	(black gooseberry)	
Acer glabrum	(Douglas maple)	
[*Cornus sericea*	(red-osier dogwood)]	
[*Corylus cornuta*	(hazelnut)]	
[*Lonicera involucrata*	(black twinberry)]	

Herb Layer: 80% cover

Gymnocarpium dryopteris	(oak fern)	)- dominants
Tiarella unifoliata	(one-leaved foamflower)	)
Circaea alpina	(enchanter's nightshade)	)
Dryopteris assimilis	(spiny wood fern)	)
Athyrium filix-femina	(lady fern)	
Matteucia struthiopteris	(ostrich fern)	- mod. cover; characteristic
Equisetum pratense	(meadow horsetail)	- good indicator
Mitella nuda	(common mitrewort)	
[*Cornus canadensis*	(bunchberry)]	
[*Tiarella trifoliata*	(three-leaved foamflower)]	
[*Smilacina racemosa*	(false Solomon's-seal)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	
[*Streptopus roseus*	(rosy twistedstalk)]	
[*Viola* spp	(violets)]	
[*Disporum hookeri*	(Hooker's fairybells)]	
[*Rubus pubescens*	(trailing raspberry)]	

Moss Layer: 25% cover; poorly developed

Mnium insigne
[*Brachythecium curtum*]
[*Timmia austriaca*]

ICHf/05 DEVIL'S CLUB - OSTRICH FERN

SOIL AND SITE:

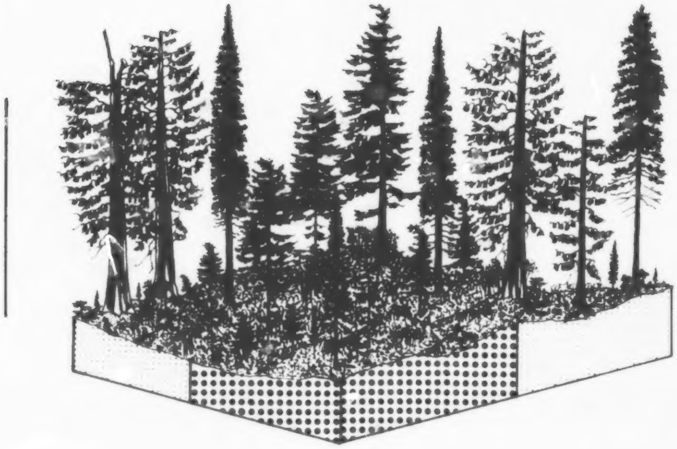
Slope Gradient (%): 3 (2-3)
Soil Classification: Gleysol and gleyed subgroups
Coarse Fragment (%): 26 (14-38)
Soil Drainage: imperfectly - poorly
Seepage Water: may be present
Rooting Depth(cm): 19 (0-37)
Humus Thickness(cm): 12 (8-16)
Humus Form: Leptomoder and Mull
pH Mineral: 6.7

COMMENTS:
Sites are usually on flood deposits.

ICHf/06 MOUNTAIN ALDER - SKUNK CABBAGE

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/06; Alnus (incana ssp. tenuifolia) - Lysichiton; ICHf: Mountain alder - skunk cabbage association.



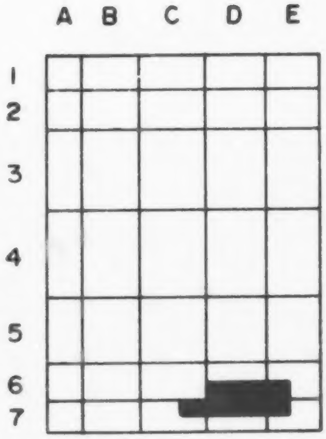
ECOLOGICAL MOISTURE REGIME: hygric (- subhydric)

ECOLOGICAL NUTRIENT REGIME: (mesotrophic -) permesotrophic - subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: lower or depression, in narrow drainage channels
Seepage Water: always present

DISTRIBUTION: uncommon



ICHf/06 MOUNTAIN ALDER - SKUNK CABBAGE

VEGETATION:

Tree Layer: 35% cover; open stands

Thuja plicata	(western redcedar)	- dominant
Tsuga heterophylla	(western hemlock)	
Abies lasiocarpa	(subalpine fir)	
Picea glauca x *engelmannii*	(hybrid white spruce)	

Shrub Layer: 45% cover, moderately high cover of regeneration

Thuja plicata		)- regeneration
Tsuga heterophylla		)
Abies lasiocarpa		)
[*Picea glauca* x *engelmannii*]		)
Alnus incana ssp. *tenuifolia*	(mountain alder)	
Vaccinium ovalifolium	(oval-leaved blueberry)	
Oplopanax horridus	(devil's club)	)- mod. cover
Vaccinium membranaceum	(black huckleberry)	
[*Ribes lacustre*	(black gooseberry)]	
[*Rubus parviflorus*	(thimbleberry)]	
[*Lonicera involucrata*	(black twinberry)]	
[*Rubus idaeus*	(red raspberry)]	

Herb Layer: 75% cover

Lysichiton americanum	(skunk cabbage)	)- dominants
Athyrium filix-femina	(lady fern)	)
Gymnocarpium dryopteris	(oak fern)	
Equisetum sylvaticum	(wood horsetail)	
Glyceria elata	(tall mannagrass)	
Valeriana sitchensis	(Sitka valerian)	
Circaea alpina	(enchanter's nightshade)	
Rubus pedatus	(five-leaved bramble)	
Cornus canadensis	(bunchberry)	
Dryopteris assimilis	(spiny wood fern)	
Tiarella unifoliata	(one-leaved foamflower)	
Viola spp.	(violets)	
Streptopus roseus	(rosy twistedstalk)	
Thelypteris phegopteris	(beech fern)	
[*Platanthera stricta*	(slender bog-orchid)]	
[*Veratrum viride*	(Indian hellebore)]	

Moss Layer: 70% cover

Sphagnum squarrosum	
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Pellia neesiana	
Pleurozium schreberi	(red-stemmed feather moss)
Rhytidiadelphus squarrosus	(bent-leaf moss)
Mnium spp.	(leafy mosses)
Sphagnum spp.	(sphagnums)
Drepanocladus spp.	
Calliergon spp.	

ICHf/06 MOUNTAIN ALDER - SKUNK CABBAGE

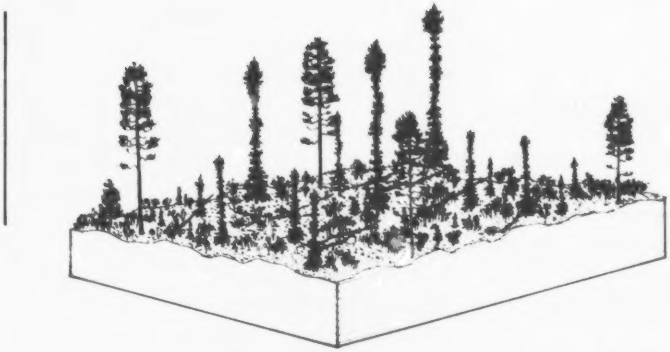
SOIL AND SITE:

Slope Gradient (%): 4 (2-11)
Parent Material: fluvial and lacustrine
Soil Classification: Gleysol and gleyed subgroup
Soil Texture: variable
Coarse Fragment (%): 7 (0-23; commonly zero)
Soil Drainage: poorly
Rooting Depth(cm): 15 (0-30)
Humus Thickness(cm): 14 (0-32)
Humus Form: Mor, Moder and Mull
pH Mineral: 4.3

ICHf/07 BLACK SPRUCE - SPHAGNUM

BIOGEOCLIMATIC UNIT: ICHf

ECOSYSTEM UNIT: ICHf/07; *Picea* (*mariana*) - *Sphagnum*; ICHf: Black spruce - sphagnum association.



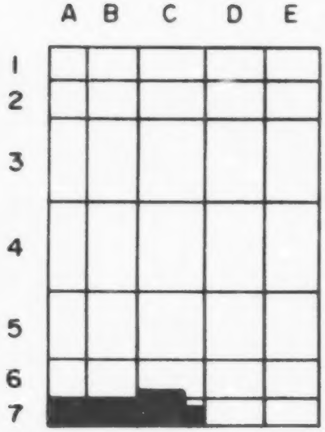
ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - mesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: level - depression
Water Table: near surface

DISTRIBUTION: uncommon



ICHf/07 BLACK SPRUCE - SPHAGNUM

VEGETATION:

Tree Layer: 15% cover; open, often clumped stands

Picea mariana	(black spruce)
Pinus contorta	(lodgepole pine)

Shrub Layer: 50% cover

Picea mariana		)- regeneration
Pinus contorta		)
[*Tsuga heterophylla*	(western hemlock)]	)
[*Thuja plicata*	(western redcedar)]	)
Ledum groenlandicum	(Labrador tea)	
Betula glandulosa	(scrub birch)	
Kalmia microphylla ssp. *occidentalis*	(bog laurel)	

Herb Layer: 70% cover

Carex spp.	(sedges)	- mod. cover
Rubus chamaemorus	(cloudberry)	
Vaccinium oxycoccos	(bog cranberry)	
Eriophorum spp.	(cotton-grasses)	
[*Lysichiton americanum*	(skunk cabbage)]	)- present with mod. cover on "richer" bogs
[*Menyanthes trifoliata*	(buckbean)]	

Moss Layer: 95% cover

Sphagnum recurvum		)- dominants
Sphagnum magellanicum		)
Sphagnum spp.	(sphagnums)	)
[*Aulacomnium palustre*	(ribbed bog moss)]	
[*Pleurozium schreberi*	(red-stemmed feather moss)]	
[*Ptilium crista-castrensis*	(knight's plume)]	

ICHf/07 BLACK SPRUCE - SPHAGNUM

SOIL AND SITE:

Slope Gradient (%):	0 (0-1)
Parent Material:	organic, organic over lacustrine, and lacustrine
Soil Classification:	Fibrisol, Mesisol and peaty-phase Gleysol
Soil Texture:	fibric - mesic, and moderately fine - fine
Soil Drainage:	(poorly -) - very poorly
Rooting Depth(cm.):	25 (15-35)
Humus Thickness(cm.):	greater than 30, usually more than 40
Humus Form:	Histomor, Histomoder and Saprimull

COMMENTS:

A variety of wetland bog ecosystems have been grouped together in this unit. They range from nutrient-poor Labrador tea - sphagnum bogs to the more nutrient "rich" scrub birch - Labrador tea - buckbean - skunk cabbage - sedge - sphagnum bog. They are all very unproductive ecosystems for forestry.

6.4.1 Discussion

Seven associations have been described in the ICHf subzone. The ranges of moisture and nutrient regimes occupied by these associations are represented in Figure 6.7.

The generalized position of each association within a catchment area is represented by Figure 6.8. Steep topography is more common than subdued topography within the subzone.

The most common association in this subzone is the ICHf/01, the Devil's club association. The percentage area of the subzone covered by this association is betwen 50% and 75%. The ICHf/02, ICHf/03, ICHf/05, and ICHf/06 are all rare or uncommon and probably cover less than five percent of the subzone.

Seral stands are extremely rare in this subzone. Only on the driest sites do seral stands seem to occur. Tree species in these stands are usually Douglas-fir, trembling aspen, and paper birch.

Dense western hemlock stands are more common in this subzone of the ICH than in the ICHj and ICHk. These stands often occur as small pockets or outliers within the SBS zone to the northwest of the ICHf subzone. The sites contained within the SBS zone appear to be drier than comparable sites in the ICHf subzone, and they will be discussed in more detail in a manual for the SBS zone. As with the other ICH subzones, dense hemlock stands within the ICHf may have to be classified on soil and site factors alone.

7.0 Ecosystem Units of the Sub-Boreal Spruce Zone.

7.1 Ecosystem Units of the SBSh

TABLE 7.1 Ecosystem (biogeocoenotic) units of the Dry Rocky Mountain Sub-boreal Spruce subzone (SBSh)

Code	Ecosystem Unit	Scientific name	Common name
SBSh/01	association	*Spiraea* - *Pleurozium*	Spirea - moss
SBSh/01.1	subassociation	*Spiraea* - *Pleurozium* - *Rubus* (*parviflorus*)	Spirea - moss - thimbleberry
SBSh/01.2	subassociation	*Spiraea* - *Pleurozium* - *Vaccinium* (*myrtilloides*)	Spirea - moss - velvet-leaved blueberry
SBSh/02	association	*Pinus* - *Cladonia*	Pine - lichen
SBSh/03	association	*Pseudotsuga* - *Peltigera*	Douglas-fir - lichen
SBSh/04	association	*Pinus* - *Shepherdia*	Pine - soopalallie
SBSh/05	association	*Pinus* - *Ledum*	Pine - Labrador tea
SBSh/05.1	subassociation	*Pinus* - *Ledum* - *Oryzopsis* (*pungens*)	Pine - Labrador tea - short-awned rice grass
SBSh/05.2	subassociation	*Pinus* - *Ledum* - *Equisetum* (*arvense*)	Pine - Labrador tea - common horsetail
SBSh/06	association	*Rubus*(*parviflorus*) - *Aralia*	Thimbleberry - wild sarsaparilla
SBSh/07	association	*Picea* (*glauca* x *engelmannii*) - *Equisetum*	Spruce - horsetail
SBSh/08	association	*Picea* (*mariana*) - *Pleurozium*	Black spruce - moss
SBSh/09	association	*Picea* (*mariana*) - *Sphagnum*	Black spruce - sphagnum

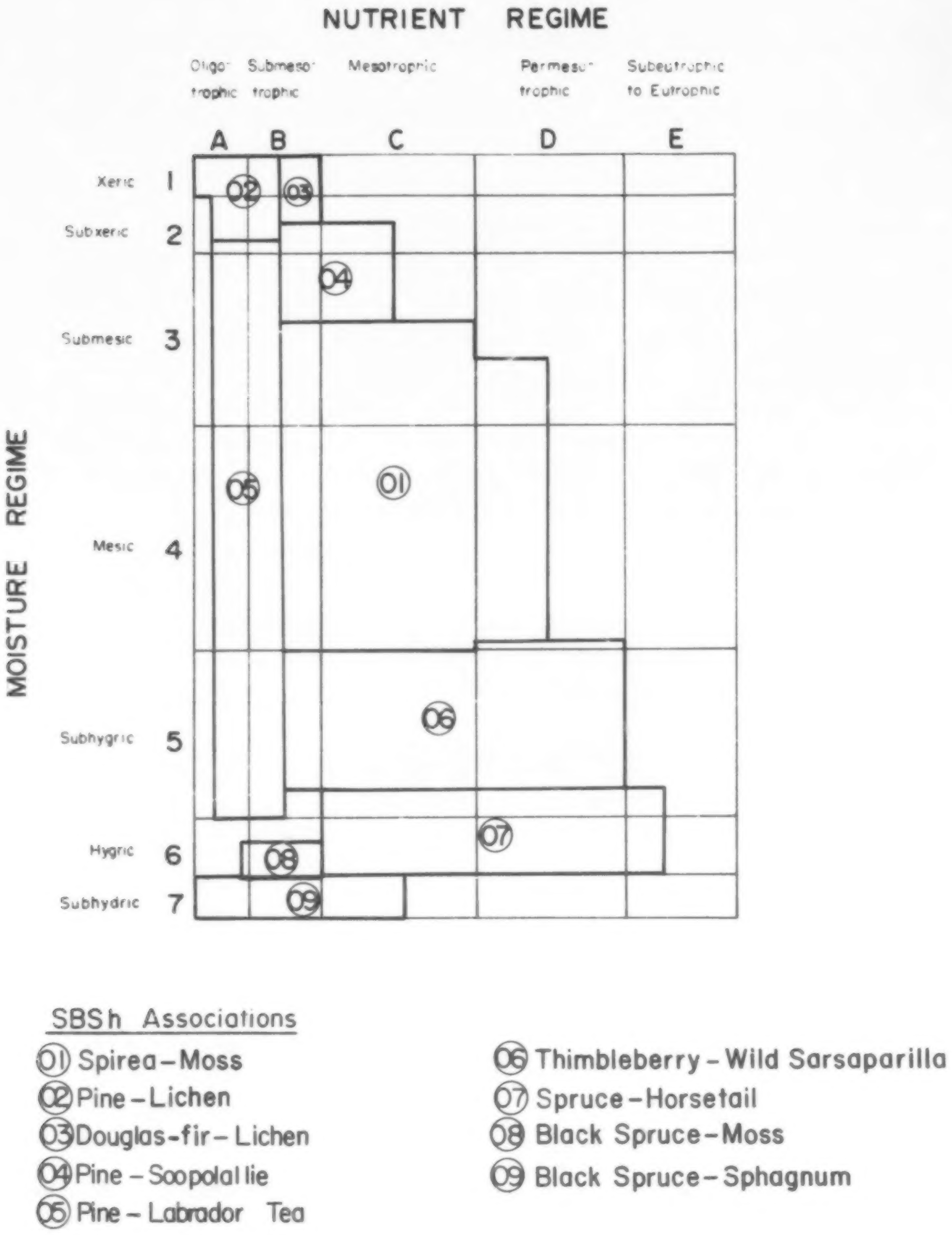

NUTRIENT REGIME
Oligotrophic
Submesotrophic
Mesotrophic
Permesotrophic
Subeutrophic to Eutrophic
A
B
C
D
E
MOISTURE REGIME
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02
03
04
05
01
06
07
08
09
SBSh Associations
01 Spirea-Moss
02 Pine-Lichen
03 Douglas-fir-Lichen
04 Pine-Soopolallie
05 Pine-Labrador Tea
06 Thimbleberry-Wild Sarsaparilla
07 Spruce-Horsetail
08 Black Spruce-Moss
09 Black Spruce-Sphagnum

FIG. 7.1 Edatopic grid of ecological moisture and nutrient regime for the SBSh subzone.

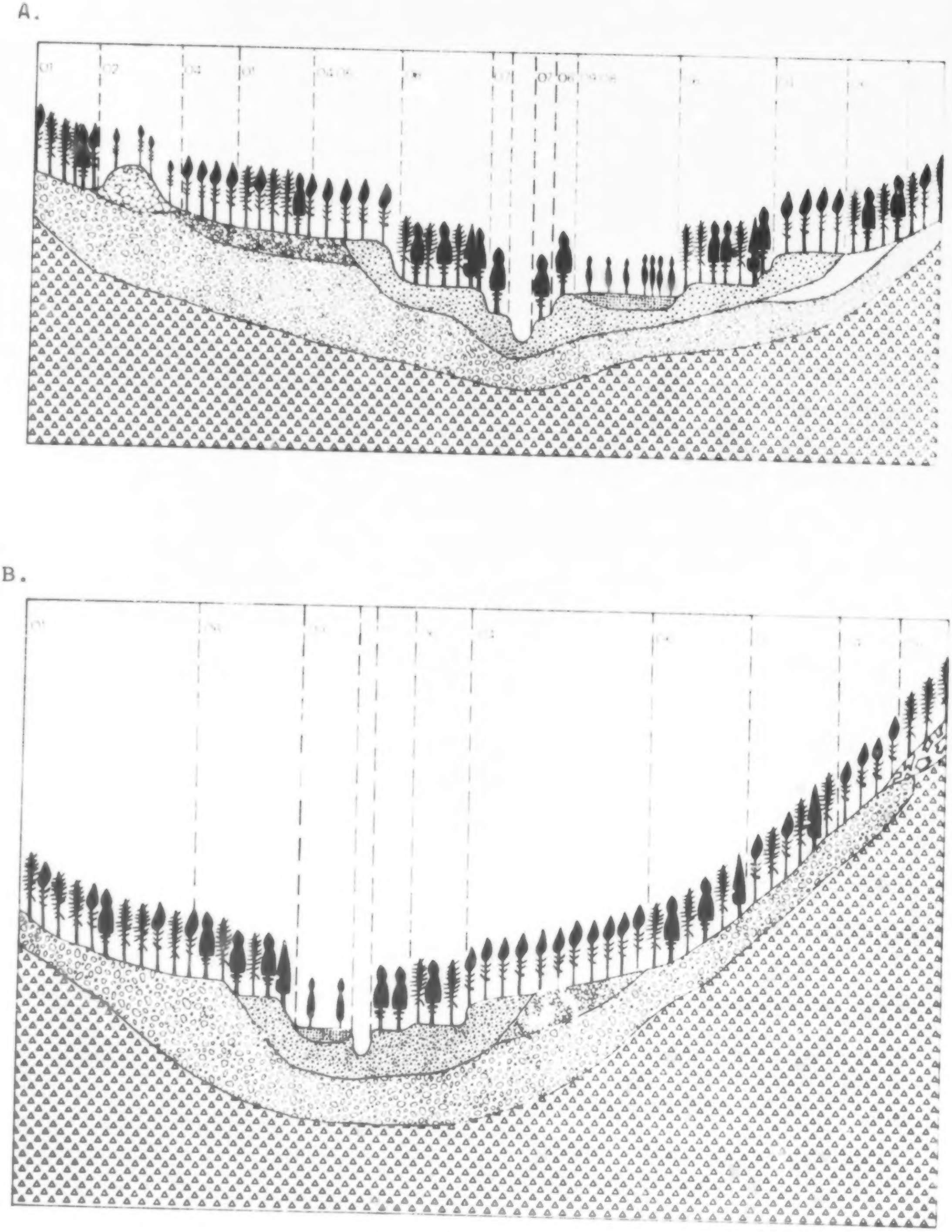
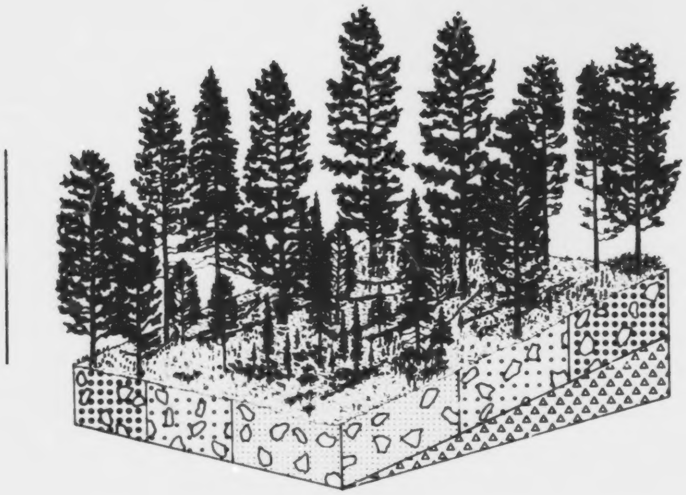

A.
O1
O2
O4
O7
O6
B.
O1

FIG. 7.2. Toposequence of associations in the SBSh subzone.
A: Subdued topography; B: Steep slopes.

SBSh/01 SPIREA - MOSS

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/01; Spiraea - Pleurozium ; SBSh: Spirea - moss association.



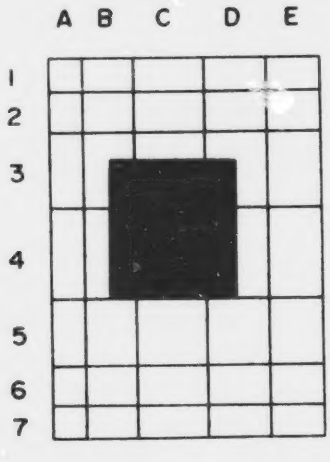
ECOLOGICAL MOISTURE REGIME: submesic - mesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic - permesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: mid
Slope Gradient (%): 20
Soil Texture: medium - moderately coarse
OR
Slope Position: lower - level
Soil Texture: usually coarse

DISTRIBUTION: very common



SBSh/01 SPIREA - MOSS

VEGETATION:

Tree Layer: 60% cover

Pseudotsuga menziesii	(Douglas-fir)	
Picea glauca x *engelmannii*	(hybrid white spruce)	
Pinus contorta	(lodgepole pine)	- seral
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 20% cover

Abies lasiocarpa		) - regeneration
[*Picea glauca* x *engelmannii*]		)
[*Pseudotsuga menziesii*]		)
Spiraea betulifolia	(birch-leaved spirea)	
Rosa acicularis	(prickly rose)	
Rubus parviflorus	(thimbleberry)	) - low cover
Viburnum edule	(highbush-cranberry)	)
Amelanchier alnifolia	(Saskatoon)	
[*Vaccinium membranaceum*	(black huckleberry)]	
[*Vaccinium myrtilloides*	(velvet-leaved blueberry)]	
[*Shepherdia canadensis*	(soopolallie)]	

Herb Layer: 35% cover

Orthilia secunda	(one-sided wintergreen)	
Chimaphila umbellata	(prince's pine)	
Linnaea borealis	(twinflower)	
Goodyera oblongifolia	(rattlesnake-plantain)	
Smilacina racemosa	(false Solomon's-seal)	
Pyrola chlorantha	(green wintergreen)	
Cornus canadensis	(bunchberry)	
Aralia nudicaulis	(wild sarsaparilla)	
Oryzopsis asperifolia	(rough-leaved ricegrass)	
Maianthemum canadense	(wild lily-of-the-valley)	
[*Disporum hookeri*	(Hooker's fairybells)]	
[*Calamagrostis rubescens*	(pinegrass)]	- occasionally present with low to mod. cover

Moss Layer: 60% cover

Pleurozium schreberi	(red-stemmed feather moss)
Rhytidiadelphus triquetrus	(electrified cat's tail moss)
Hylocomium splendens	(step moss)
Dicranum polysetum	(wavy-leaved moss)
Ptilium crista-castrensis	(knight's plume)
[*Peltigera aphthosa*]	

SBSh/01 SPIREA - MOSS

SOIL AND SITE:

Slope Gradient (%):	16 (0-55)
Parent Material:	variable but commonly fluvial or morainal
Soil Classification:	commonly Brunisol, also Podzol and Luvisol
Coarse Fragments (%):	38 (0-77, usually greater than 20)
Soil Drainage:	well - moderately well
Rooting Depth (cm):	36 (20-50)
Humus Form:	Hemimor or Mormoder
Humus Thickness (cm):	4 (2-10, less than 6)
pH Humus:	5.4
pH Mineral:	5.0

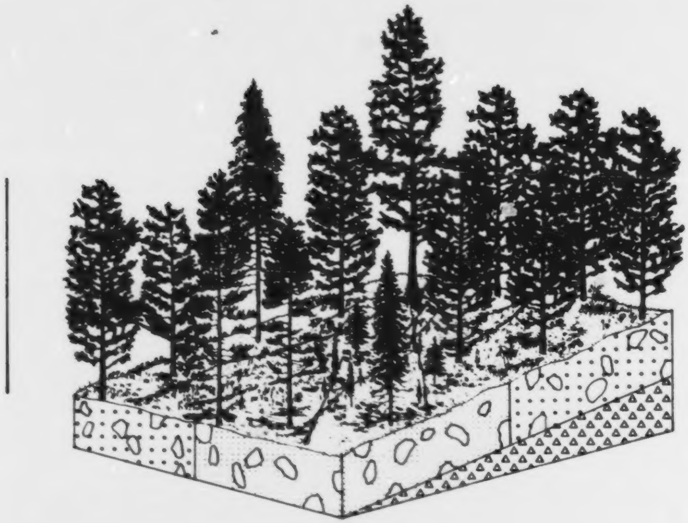
COMMENTS:

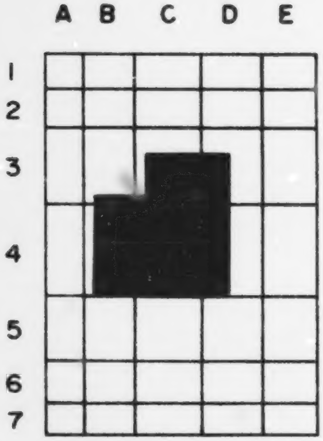
Sitka alder may occur with moderate cover on some sites. The two groupings of important environmental features do not refer to the two subassociations.

SBSh/01.1 SPIREA - MOSS - THIMBLEBERRY

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/01.1; *Spiraea* - *Pleurozium* - *Rubus parviflorus*;
SBSh: Spirea - moss - thimbleberry subassociation.





ECOLOGICAL MOISTURE REGIME: submesic - mesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic
- permesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:
Slope Position: mid - lower
Soil Texture: medium - moderately coarse
OR
Slope Position: toe - level
Soil Texture: coarse

DISTRIBUTION: common

SBSh/01.1 SPIREA - MOSS - THIMBLEBERRY

VEGETATION:

Tree Layer: 65% cover

Pseudotsuga menziesii	(Douglas-fir)	
Picea glauca x engelmannii	(hybrid white spruce)	
Pinus contorta	(lodgepole pine)	- seral
[Abies lasiocarpa	(subalpine fir)]	

Shrub Layer: 20% cover

Abies lasiocarpa		) - regeneration
[Picea glauca x engelmannii]		)
[Pseudotsuga menziesii]		)
Spiraea betulifolia	(birch-leaved spirea)	
Rubus parviflorus	(thimbleberry)	- low cover
Rosa acicularis	(prickly rose)	
Viburnum edule	(highbush-cranberry)	- low cover
Amelanchier alnifolia	(Saskatoon)	
Cornus sericea	(red-osier dogwood)	- low cover
[Vaccinium myrtilloides	(velvet-leaved blueberry)]	)
[Shepherdia canadensis	(soopolallie)]	)

Herb Layer: 50% cover

Smilacina racemosa	(false Solomon's-seal)	
Orthilia secunda	(one-sided wintergreen)	
Linnaea borealis	(twinflower)	
Chimaphila umbellata	(prince's pine)	
Maianthemum canadense	(wild lily-of-the-valley)	
Disporum hookeri	(Hooker's fairybells)	- good indicator
Cornus canadensis	(bunchberry)	
Aralia nudicaulis	(wild sarsaparilla)	- low to mod. cover
Oryzopsis asperifolia	(rough-leaved ricegrass)	
Aster conspicuus	(showy aster)	
[Pyrola chlorantha	(green wintergreen)]	
[Goodyera oblongifolia	(rattlesnake-plantain)]	
[Aster ciliolatus	(fringed aster)]	)- good indicators, if
[Galium triflorum	(sweet-scented bedstaw)]	) present
[Streptopus roseus	(rosy twistedstalk)]	)
[Lathyrus ochroleucus	(creamy peavine)]	
[Calamagrostis rubescens	(pinegrass)]	- occasionally present with low to mod. cover

Moss Layer: 50% cover

Pleurozium schreberi	(red-stemmed feather moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
Hylocomium splendens	(step moss)
Dicranum polysetum	(wavy-leaved moss)
Ptilium crista-castrensis	(knight's plume)
[Peltigera aphthosa]	

SBSh/01.1 SPIREA - MOSS - THIMBLEBERRY SUBASSOCIATION

SOIL AND SITE:

Slope Gradient (%):	15 (0-33)
Parent Material:	commonly fluvial or morainal
Soil Classification:	commonly Brunisol or Luvisol
Coarse Fragments (%):	27 (0-50)
Soil Drainage:	moderately well - well
Rooting Depth (cm):	36 (16-50)
Humus Form:	usually Hemimor or Mormoder
Humus Thickness (cm):	4 (2-10, usually less than 6)
pH Humus:	5.7
pH Mineral:	5.2

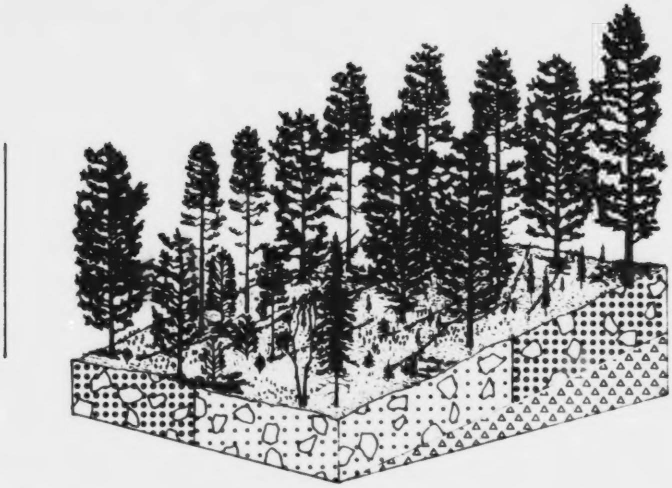
COMMENTS:

These sites seem slightly moister than the SBSh/01.2.

SBSh/01.2 SPIREA - MOSS - VELVET-LEAVED BLUEBERRY

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/01.2; Spiraea - Pleurozium - Vaccinium (myrtilloides);
SBSh: Spirea - moss - velvet-leaved blueberry subassociation.



ECOLOGICAL MOISTURE REGIME: submesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:
Slope Position: mid
Soil Texture: moderately coarse
Course Fragments (%): 59 (35-77)
OR
Slope Position: level
Soil Texture: coarse

DISTRIBUTION: common

	A	B	C	D	E
1					
2					
3		■			
4					
5					
6					
7					

SBSh/01.2 SPIREA - MOSS - VELVET-LEAVED BLUEBERRY

VEGETATION:

Tree Layer: 60% cover

Pseudotsuga menziesii	(Douglas-fir)	
Pinus contorta	(lodgepole pine)	- seral
Picea glauca x *engelmannii*	(hybrid white spruce)	

Shrub Layer: 20% cover; poorly developed, mostly regeneration

Abies lasiocarpa	(subalpine fir)	) - regeneration
Picea glauca x *engelmannii*		)
Pseudotsuga menziesii		)
Spiraea betulifolia	(birch-leaved spirea)	
Rosa acicularis	(prickly rose)	
Amelanchier alnifolia	(Saskatoon)	
Vaccinium myrtilloides	(velvet-leaved blueberry)	
Vaccinium membranaceum	(black huckleberry)	
[*Shepherdia canadensis*	(soopolallie)]	
[*Menziesia ferruginea*	(false azalea)]	
[*Rubus parviflorus*	(thimbleberry)]	- occasionally present with very low cover

Herb Layer: 25% cover; usually poorly developed

Chimaphila umbellata	(prince's pine)	
Linnaea borealis	(twinflower)	
Ortnilia secunda	(one-sided wintergreen)	
Goodyera oblongifolia	(rattlesnake-plantain)	
Cornus canadensis	(bunchberry)	
Smilacina racemosa	(false Solomon's-seal)	
Oryzopsis asperifolia	(rough-leaved ricegrass)	
Maianthemum canadense	(wild lily-of-the-valley)	
[*Pyrola chlorantha*	(green wintergreen)]	
[*Aralia nudicaulis*	(wild sarsaparilla)]	- low cover
[*Platanthera orbiculata*	(round-leaved rein-orchid)]	
[*Calypso bulbosa*	(fairy-slipper)]	
[*Calalmagrostis rubescens*	(pinegrass)]	- occasionally present with low cover

Moss Layer: 70% cover

Pleurozium schreberi	(red-stemmed feather moss)
Dicranum polysetum	(wavy-leaved moss)
Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
Ptilium crista-castrensis	(knight's plume)
[*Peltigera aphthosa*]	

SBSh/01.2 SPIREA - MOSS - VELVET-LEAVED BLUEBERRY

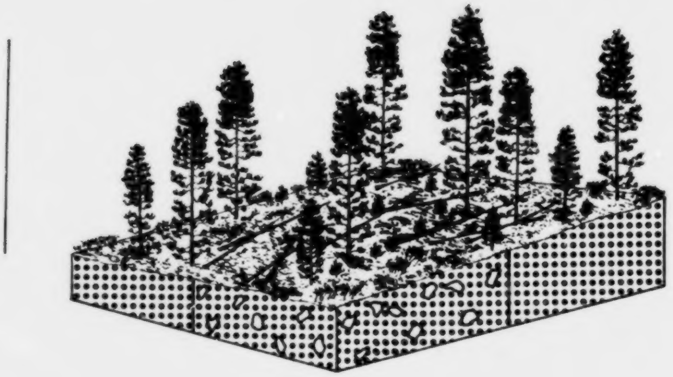
SOIL AND SITE:

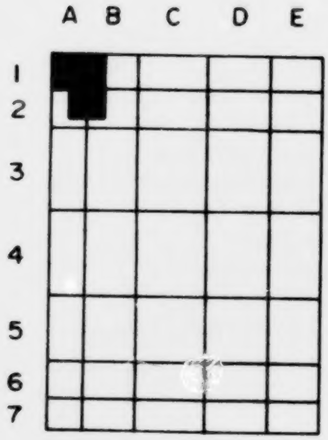
Slope Gradient (%):	19 (4-55, usually less than 30)
Parent Material:	variable, but relatively coarse-textured
Soil Classification:	Dystric Brunisol and Orthic Humo-Ferric Podzol
Coarse Fragments (%):	53 (0-77, usually greater than 40)
Soil Drainage:	well - moderately well
Rooting Depth (cm):	36 (20-50)
Humus Form:	usually Hemimor
Humus Thickness (cm):	4 (2-8, usually less than 6)
pH Humus:	5.1
pH Mineral:	4.8

SBSh/02 PINE - LICHEN

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/02; Pinus - Cladina; SBSh: Pine - lichen association.





ECOLOGICAL MOISTURE REGIME: xeric (- subxeric)

ECOLOGICAL NUTRIENT REGIME: oligotrophic
- submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Parent Material: glaciofluvial or eolian
Soil Texture: coarse

DISTRIBUTION: common

SBSh/02 PINE - LICHEN

VEGETATION:

Tree Layer: 30% cover; open stands

Pinus contorta	(lodgepole pine)	

Shrub Layer: 20% cover

Pinus contorta		- regeneration
Vaccinium myrtilloides	(velvet-leaved blueberry)	- variable cover
[*Shepherdia canadensis*	(soopolalie)]	- low cover

Herb Layer: 20% cover

Arctostaphylos uva-ursi	(kinnikinnick)	- mod. to high cover
Melampyrum lineare	(cow-wheat)	- short-lived; easily missed
[*Cornus canadensis*	(bunchberry)]	
[*Chimaphila umbellata*	(prince's pine)]	
[*Apocynum androsaemifolium*	(spreading dogbane)]	
[*Linnaea borealis*	(twinflower)]	
[*Oryzopsis pungens*	(short-awned ricegrass)]	
[*Campanula rotundifolia*	(common harebell)]	
[*Pyrola chlorantha*	(green wintergreen)]	
[*Vaccinium vitis-idaea*	(lingonberry)]	- occasionally present with moderate cover

Moss Layer: 60% cover; dominated by lichens

Cladina spp.	
Peltigera spp.	
Cladonia spp.	
Polytrichum spp.	(haircap mosses)
Dicranum polysetum	(wavy-leaved moss)
Pleurozium schreberi	(red-stemmed feather moss)

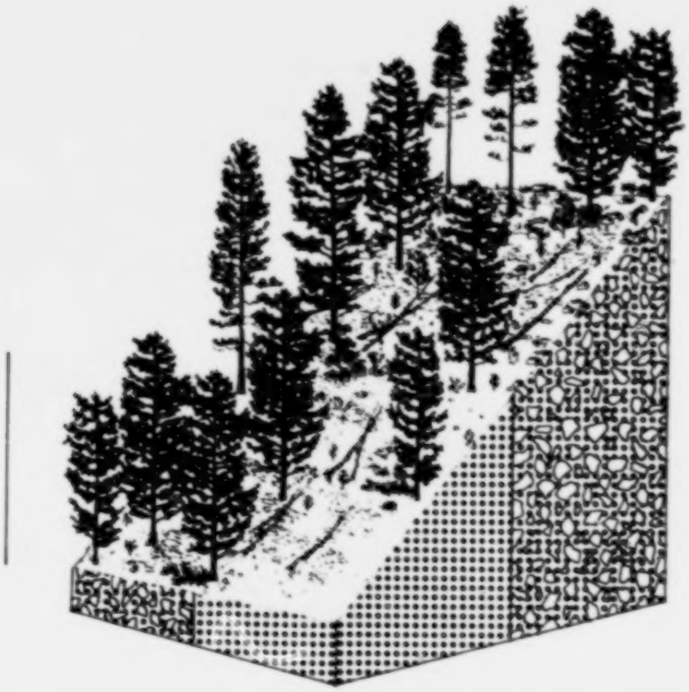
SOIL AND SITE:

Slope Gradient (%): 7 (0-15)
Slope Position: variable
Soil Classification: Eluviated and Orthic Dystric Brunisol
Coarse Fragments (%): 16 (0-80)
Soil Drainage: rapidly
Rooting Depth (cm): 37 (25-50)
Humus Form: Xeromor
Humus Thickness (cm): 4 (1-6)
pH Humus: 4.4
pH Mineral: 5.0

SBSh/03 DOUGLAS-FIR - LICHEN

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/03; Pseudotsuga - Peltigera; SBSh: Douglas-fir - lichen association.



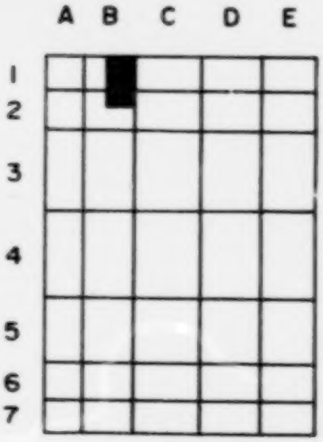
ECOLOGICAL MOISTURE REGIME: xeric - subxeric

ECOLOGICAL NUTRIENT REGIME: submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Aspect: SE to SW
Slope Gradient (%): 66 (56-75)
Slope Position: mid - upper
Soil Texture: coarse; or medium with high coarse fragments

DISTRIBUTION: rare



SBSh/03 DOUGLAS FIR - LICHEN

VEGETATION:

Tree Layer: 45% cover

Pseudotsuga menziesii	(Douglas-fir)	
Pinus contorta	(lodgepole pine)	

Shrub layer: 10% cover

Pseudotsuga menziesii		- regeneration
Spiraea betulifolia	(birch-leaved spirea)	
Shepherdia canadensis	(soopolallie)	
[*Rosa acicularis*	(prickly rose)]	

Herb Layer: 15% cover

Arctostaphylos uva-ursi	(kinnikinnick)	
Calamagrostis rubescens	(pinegrass)	) - highly variable
Elymus innovatus	(fuzzy-spiked wildrye)	) cover
Solidago spathulata	(dryland goldenrod)	
Aster conspicuus	(showy aster)	
[*Campanula rotundifolia*	(common harebell)]	
[*Oryzopsis pungens*	(short-awned ricegrass]	
[*Antennaria neglecta*	(field pussytoes)]	
[*Arabis holboellii*	(Holboell's rockcress)]	
[*Achillea millefolium*	(yarrow)]	

Moss Layer: 30% cover

Pleurozium schreberi	(red-stemmed feather moss)	) - highly variable
Dicranum polysetum	(wavy-leaved moss)	) cover
Peltigera canina	(dog lichen)	
Peltigera malacea		
Cladina spp.		
Cladonia spp.		
[*Ptilium crista-castrensis*	(knight's plume)]	
[*Polytrichum juniperinum*	(juniper haircap moss)]	
[*Hylocomium splendens*	(step moss)]	

SBSh/03 DOUGLAS-FIR - LICHEN

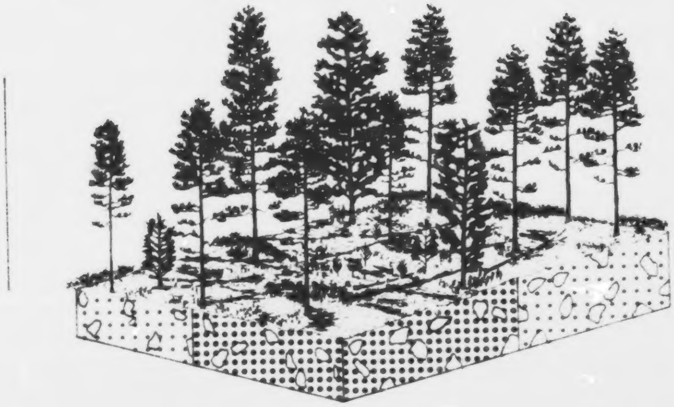
SOIL AND SITE:

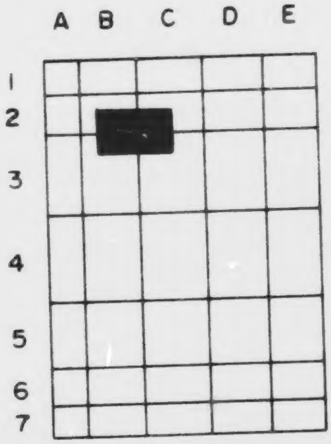
Parent Material:	colluvium or fluvial and glaciofluvial terraces
Soil Classification:	Brunisol
Coarse Fragments (%):	52 (0-80, usually greater than 50)
Soil Drainage:	rapidly - well
Rooting Depth (cm):	50 (27-68)
Humus Form:	Xeromor
Humus Thickness (cm):	3 (1-4)
pH Humus:	5.1
pH Mineral:	5.1

SBSh/04 PINE - SOOPOLALLIE

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/04; Pinus - Shepherdia; SBSh: Pine - soopolallie association.





ECOLOGICAL MOISTURE REGIME: subxeric - submesic

ECOLOGICAL NUTRIENT REGIME: submesotrophic
(- mesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: mid - upper or level
Soil Texture: moderately coarse or coarse

DISTRIBUTION: very common

SBSh/04 PINE - SOOPOLALLIE

VEGETATION:

Tree Layer: 45% cover

Pinus contorta	(lodgepole pine)	
Pseudotsuga menziesii	(Douglas-fir)	

Shrub Layer: 35% cover

Pseudotsuga menziesii		
[*Pinus contorta*]		) - regeneration
[*Abies lasiocarpa*	(subalpine fir)]	)
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	)
Shepherdia canadensis	(soopolallie)	- mod. to high cover
Spiraea betulifolia	(birch-leaved spirea)	
Vaccinium myrtilloides	(velvet-leaved blueberry)	
Rosa acicularis	(prickly rose)	
Amelanchier alnifolia	(Saskatoon)	

Herb Layer: 50% cover

Linnaea borealis	(twinflower)	
Chimaphila umbellata	(prince's pine)	
Cornus canadensis	(bunchberry)	
Maianthemum canadensis	(wild lily-of-the valley)	
Arctostaphylos uva-ursi	(kinnikinnick)	
Elymus innovatus	(fuzzy-spiked wildrye)	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Melampyrum lineare*	(cow-wheat)]	) - short-lived; easily missed
[*Oryzopsis asperifolia*	(rough-leaved ricegrass)]	
[*Aster ciliolatus*	(fringed aster)]	
[*Fragaria virginiana*	(wild strawberry)]	
[*Platanthera orbiculata*	(round-leaved rein orchid)]	
[*Pyrola chlorantha*	(green wintergreen)]	
[*Calamagrostis rubescens*	(pinegrass)]	- cover highly variable
[*Campanula rotundifolia*	(common harebell)]	
[*Lathyrus ochroleucus*	(creamy peavine)]	
[*Aster conspicuus*	(showy aster)]	
[*Vaccinium vitis-idaea*	(lingonberry)]	- occasionally present with low to moderate cover

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feather moss)	- high cover
Dicranum polysetum	(wavy-leaved moss)	- occasionally high cover
[*Hylocomium splendens*	(step moss)]	
[*Peltigera aphthosa*]		

SBSh/04 PINE - SOOPOLALLIE

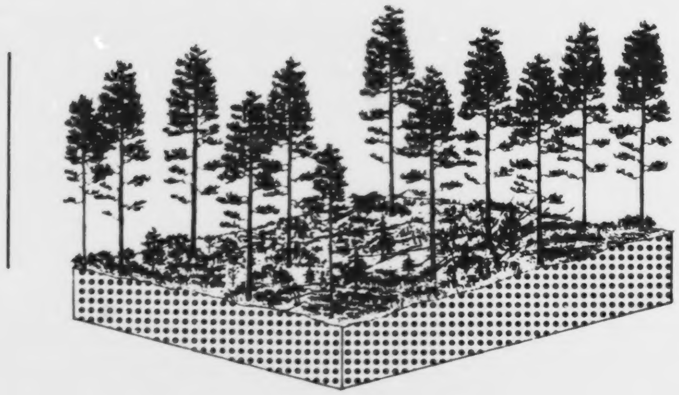
SOIL AND SITE:

Slope Gradient (%): 3 (0-14, commonly less than 10)
Parent Material: usually fluvial or glaciofluvial, also morainal
Soil Classification: usually Dystric Brunisol
Coarse Fragments (%): 38 (0-85, usually greater than 20)
Soil Drainage: rapidly - well
Rooting Depth (cm): 39 (20-60)
Humus Form: Xeromor and Hemimor
Humus Thickness (cm): 3 (1-6, usually less than 4)
pH Humus: 4.9
pH Mineral: 5.1

SBSh/05 PINE - LABRADOR TEA

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/05; Pinus - Ledum; SBSh: Pine - Labrador tea association.



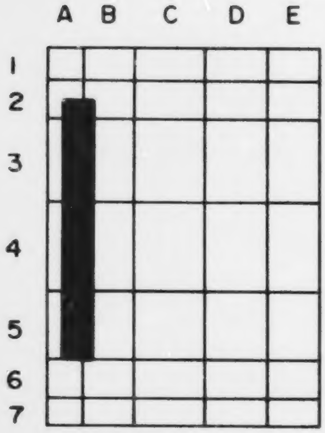
ECOLOGICAL MOISTURE REGIME: (subxeric-) submesic - subhygric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: level
Parent Material: fluvial
Soil Texture: coarse

DISTRIBUTION: uncommon



SBSh/05 PINE - LABRADOR TEA

VEGETATION:

Tree Layer: 45% cover

Pinus contorta	(lodgepole pine)	

Shrub Layer: 65% cover

Pinus contorta		) - regeneration
[*Picea glauca* x *engelmannii*	(hybrid white spruce)]	)
Ledum groenlandicum	(Labrador tea)	- characteristic dominant
Vaccinium myrtilloides	(velvet-leaved blueberry)	- mod. cover
Shepherdia canadensis	(soopollalie)	
[*Salix scouleriana*	(Scouler's willow)]	
[*Salix bebbiana*	(Bebb's willow)]	
[*Rosa acicularis*	(prickly rose)]	
[*Spiraea betulifolia*	(birch-leaved spirea)]	

Herb Layer: 60% cover

Vaccinium vitis-idaea	(lingonberry)	- good indicator
Cornus canadensis	(bunchberry)	
Arctostaphylos uva-ursi	(kinnikinnick)	
Linnaea borealis	(twinflower)	
Lycopodium complanatum	(ground-cedar)	- good indicator
Maianthemum canadense	(wild lily-of-the-valley)	
Oryzopsis asperifolia	(rough-leaved ricegrass)	
[*Lathyrus ochroleucus*	(creamy peavine)]	
[*Aster ciliolatus*	(fringed aster)]	
[*Campanula rotundifolia*	(common harebell)]	
[*Fragaria virginiana*	(wild strawberry)]	
[*Melampyrum lineare*	(cow-wheat)]	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Equisetum hyemale*	(scouring-rush)]	

Moss Layer: 98% cover

Pleurozium schreberi	(red-stemmed feather moss)	- very high cover
Dicranum polysetum	(wavy-leaved moss)	
Hylocomium splendens	(step moss)]	
[*Peltigera leucophlebia*]		
[*Cladonia gracilis*]		
[*Peltigera malacea*]		

SBSh/05 PINE - LABRADOR TEA

SOIL AND SITE:

Slope Gradient (%):	1 (0-2)
Soil Classification:	Dystric Brunisol
Coarse Fragments (%):	1 (0-2)
Soil Drainage:	well - imperfectly
Rooting Depth (cm):	30 (27-31)
Seepage Water:	usually present in wet subassociation
Humus Form:	Hemimor
Humus Thickness (cm):	5 (3-7)
pH Mineral:	4.8

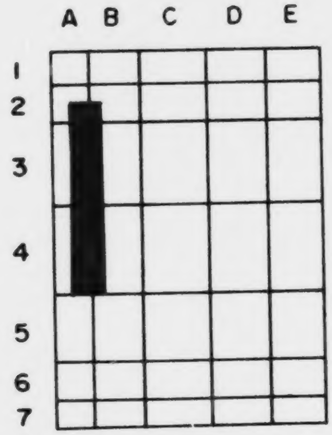
COMMENTS:

This association has been broken into two subassociations, one drier and one wetter than the other. The minor floristic differences between the two subassociations are due to moisture.

SBSh/05.1 PINE - LABRADOR TEA - SHORT-AWNED RICEGRASS

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/05.1; *Pinus* - *Ledum* - *Oryzopsis* (*pungens*);
SBSh: Pine - Labrador tea - short-awned ricegrass
subassociation.



ECOLOGICAL MOISTURE REGIME: (subxeric-) submesic - mesic

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES: same as for SBSh/05 PLUS:

Soil Drainage: Well

DISTRIBUTION: uncommon

VEGETATION: same as SBSh/05 PLUS:

Herb Layer:

Oryzopsis pungens	(short-awned ricegrass)
[*Antennaria neglecta*	(field pussytoes)]
[*Hieracium umbellatum*	(narrow-leaved hawkweed)]

Moss Layer:

Cladina mitis	- low cover

SOIL AND SITE: same as SBSh/05 EXCEPT

Soil Classification: Eluviated Dystric
Brunisol

COMMENTS:

Based on limited data.

SBSh/05.2 PINE - LABRADOR TEA - COMMON HORSETAIL

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/05.2; *Pinus* - *Ledum* - *Equisetum* (*arvense*);
SBSh: Pine - Labrador tea - common horsetail subassociation.

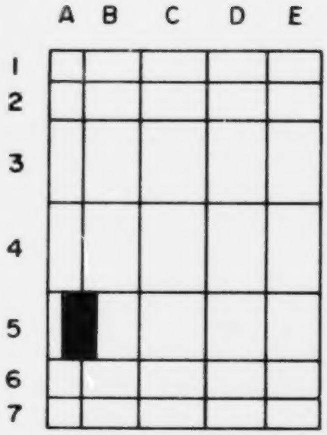
ECOLOGICAL MOISTURE REGIME: subhygric

ECOLOGICAL NUTRIENT REGIME: oligotrophic - submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES: same as for SBSh/05 PLUS:

Seepage Water: present (often at depths greater than 100 cm)

DISTRIBUTION: uncommon



VEGETATION: same as SBSh/05 PLUS:

Herb Layer:

Equisetum arvense	(common horsetail)
[*Geocaulon lividum*	(bastard toad-flax)]
[*Goodyera oblongifolia*	(rattlesnake-plantain)]
[*Lycopodium obscurum*	(ground-pine)]

SOIL AND SITE: same as SBSh/05 EXCEPT:

Soil Classification: Gleyed Eluviated Dystric Brunisol
Soil Drainage: moderately well - imperfectly

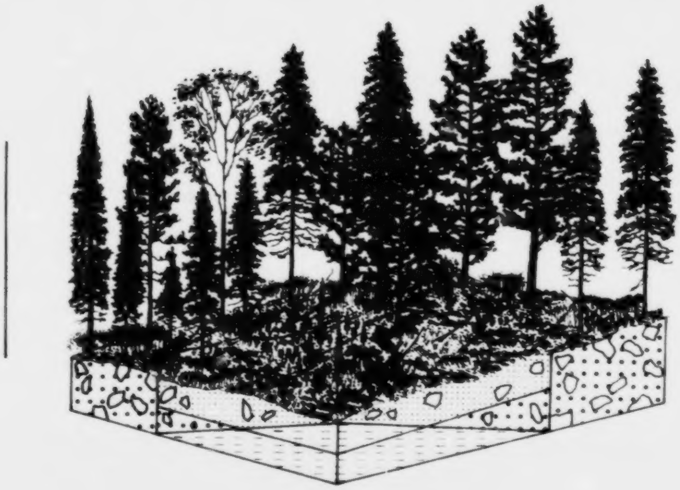
COMMENTS:

Based on limited data.

SBSh/06 THIMBLEBERRY - WILD SARSAPARILLA

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/06; *Rubus* (*parviflorus*) - *Aralia*; SBSh: Thimbleberry - wild sarsaparilla association.



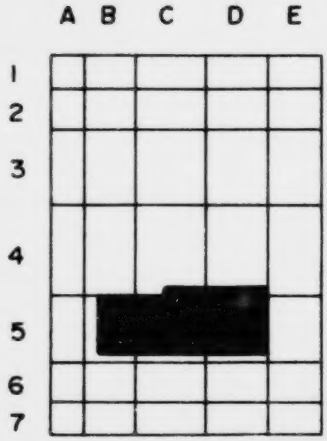
ECOLOGICAL MOISTURE REGIME: (mesic-) subhygric

ECOLOGICAL NUTRIENT REGIME: submesotrophic
- permesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Gradient: 6 (0-13)
Slope Position: lower - level

DISTRIBUTION: common



SBSh/06 THIMBLEBERRY - WILD SARSAPARILLA

VEGETATION:

Tree Layer: 65% cover

Picea glauca x *engelmannii*	(hybrid white spruce)	
Pseudotsuga menziesii	(Douglas-fir)	) - seral
Populus tremuloides	(trembling aspen)	)
Pinus contorta	(lodgepole pine)	)
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 45% cover

Picea glauca x *engelmannii*		) - regeneration
Abies lasiocarpa		)
Rubus parviflorus	(thimbleberry)	) - moderate cover
Cornus sericea	(red-osier dogwood)	)
Viburnum edule	(highbush-cranberry)	
Lonicera involucrata	(black twinberry)	
Spiraea betulifolia	(birch-leaved spirea)	
Amelanchier alnifolia	(Saskatoon)	
Rosa acicularis	(prickly rose)	
[*Vaccinium myrtilloides*	(velvet-leaved blueberry)]	
[*Menziesia ferruginea*	(false azalea)]	

Herb Layer: 55% cover

Aralia nudicaulis	(wild sarsaparilla)	- characteristic dominant
Smilacina racemosa	(false Solomon's-seal)	
Disporum hookeri	(Hooker's fairybells)	
Oryzopsis asperifolia	(rough-leaved ricegrass)	
Linnaea borealis	(twinflower)	
Cornus canadensis	(bunchberry)	
Maianthemum canadense	(wild lily-of-the-valley)	
Clintonia uniflora	(queen's cup)	
Rubus pubescens	(trailing raspberry)	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Galium triflorum*	(sweet-scented bedstraw)]	
[*Lathyrus ochroleucus*	(creamy peavine)]	
[*Goodyera oblongifolia*	(rattlesnake-plantain)]	
[*Goodyera repens*	(dwarf rattlesnake orchid)]	
[*Pyrola chlorantha*	(green wintergreen)]	
[*Actaea rubra*	(baneberry)]	
[*Chimaphila umbellata*	(prince's pine)]	
[*Petasites palmatus*	(palmate colt's-foot)]	

Moss Layer; 40% cover

Pleurozium schreberi	(red-stemmed feather-moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail)
[*Ptilium crista-castrensis*	(knight's plume)]
[*Hylocomium splendens*	(step moss)]
[*Dicranum polysetum*]	(wavy-leaved moss)

SBSh/06 THIMBLEBERRY - WILD SARSAPARILLA

SOIL AND SITE:

Parent Material:	variable
Soil Classification:	dominantly Luvisol; also Podzol and Brunisol - often gleyed subgroups
Soil Texture:	variable (coarse through to fine)
Coarse Fragments (%):	16 (0-35)
Soil Drainage:	moderately well - imperfectly
Rooting Depth (cm):	33 (18-60)
Seepage Water:	may be present
Humus Form:	Hemimor, Humimor, and Mormoder
Humus Thickness (cm):	6 (2-9)
pH Humus:	5.0
pH Mineral:	5.2

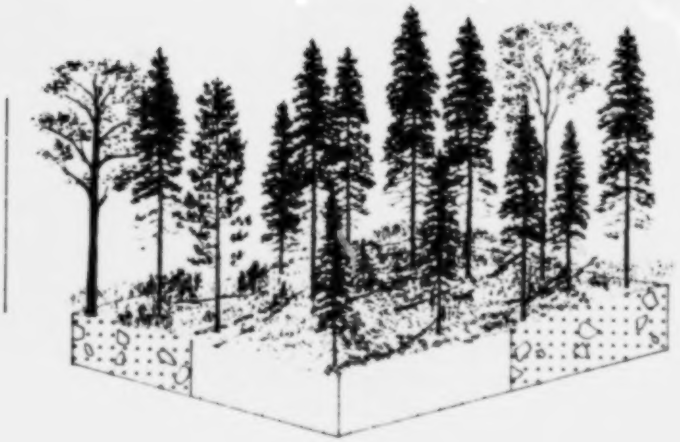
COMMENTS:

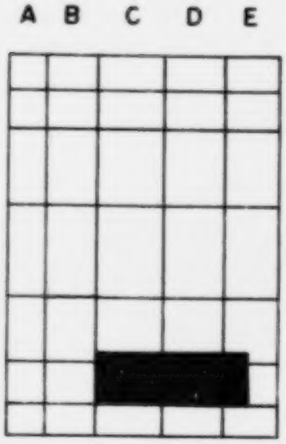
Most sites, but especially those with moderately coarse and coarse textures, receive some seepage in the early part of the growing season or after heavy rainfall.

SBSh/07 SPRUCE - HORSETAIL

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/07; *Picea* (*glauca* x *engelmannii*) - *Equisetum*;
SBSh: Spruce - horsetail association.





ECOLOGICAL MOISTURE REGIME: subhygric - hygric

ECOLOGICAL NUTRIENT REGIME: mesotrophic
- subeutrophic

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: level
Slope Gradient: 0.5 (0-2)
Parent Material: fluvial
Seepage Water: often present

DISTRIBUTION: common, but small in size

SBSh/07 SPRUCE - HORSETAIL

VEGETATION:

Tree Layer: 65% cover

Picea glauca x *engelmannii*	(hybrid white spruce)	
[*Populus balsamifera*	(cottonwood)]	- seral
[*Abies lasiocarpa*	(subalpine fir)]	

Shrub Layer: 35% cover

Picea glauca x *engelmannii*		- regeneration
Cornus sericea	(red-osier dogwood)	) - characteristic dominants
Viburnum edule	(highbush-cranberry)	)
Lonicera involucrata	(black twinberry)	)
Rosa acicularis	(prickly rose)	
Rubus idaeus	(red raspberry)	- good indicator, if present

Herb Layer: 60% cover

Equisetum arvense	(common horsetail)	) - characteristic dominants
Equisetum pratense	(meadow horsetail)	)
Aralia nudicaulis	(wild sarsaparilla)	
Smilacina racemosa	(false Solomon's-seal)	
Rubus pubescens	(trailing raspberry)	
Cornus canadensis	(bunchberry)	
Galium triflorum	(sweet-scented bedstraw)	
Petasites palmatus	(palmate colt's-foot)	
Mitella nuda	(common mitrewort)	
Gymnocarpium dryopteris	(oak fern)	
[*Dryopteris assimilis*	(spiny wood fern)]	
[*Orthilia secunda*	(one-sided wintergreen)]	
[*Pyrola asarifolia*	(pink wintergreen)]	
[*Pyrola chlorantha*	(green wintergreen)]	
[*Aster ciliolatus*	(fringed aster)]	
[*Maianthemum canadense*	(wild lily-of-the-valley)]	
[*Streptopus amplexifolius*	(clasping twistedstalk)]	)- good indicators,
[*Viola* spp.	(violets)]	) if present
[*Cinna latifolia*	(nodding wood-reed)]	)
[*Actaea rubra*	(baneberry)]	)

Moss Layer: 30% cover; poorly developed in general; variable cover

Rhytidiadelphus triquetrus	(electrified cat's-tail)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feather moss)
Mnium spp.	(leafy mosses)

SBSh/07 SPRUCE - HORSETAIL

SOIL AND SITE:

Soil Classification:	Gleysol and gleyed subgroups
Soil Texture:	medium, moderately coarse and coarse
Coarse Fragments (%):	18 (0-44, commonly 0)
Soil Drainage:	imperfectly - poorly
Rooting Depth (cm):	30 (13-60)
Humus Form:	commonly moder, also mull
Humus Thickness (cm):	12 (1-45; where less than 7, an Ah horizon present)
pH Humus:	5.9
pH Mineral:	6.0

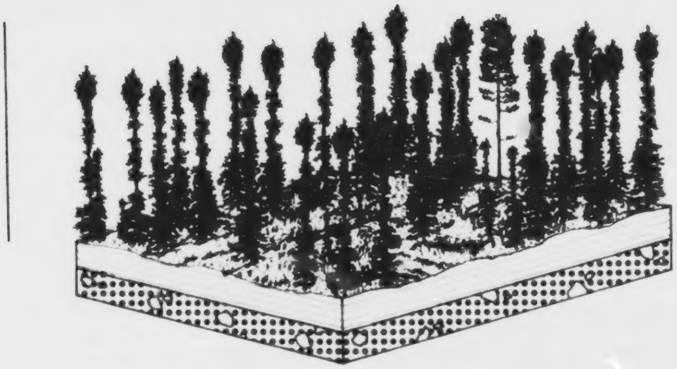
COMMENTS:

These sites often have a fluctuating water table. They are generally nutrient-rich and fertile.

SBSh/08 BLACK SPRUCE - MOSS

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/08; Picea (mariana) - Pleurozium; Black spruce - moss association.

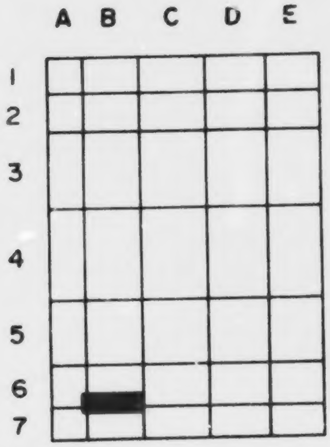


ECOLOGICAL MOISTURE REGIME: hygric (- subhydric)

ECOLOGICAL NUTRIENT REGIME: submesotrophic

IMPORTANT ENVIRONMENTAL FEATURES:
Slope Position: depression
Parent Material: organic veneer over fluvial
Water Table: close to surface

DISTRIBUTION: rare



SBSh/08 BLACK SPRUCE - MOSS

VEGETATION:

Tree Layer: 65% cover

Picea mariana	(black spruce)
[*Pinus contorta*	(lodgepole pine)]

Shrub Layer: 10% cover

Picea mariana		- regeneration
Ledum groenlandicum	(Labrador tea)	
Alnus incana ssp. *tenuifolia*	(mountain alder)	
[*Cornus sericea*	(red-osier dogwood)]	
[*Ribes hudsonianum*	(northern black currant)]	

Herb Layer: 25% cover

Carex disperma	(soft-leaved sedge)
Carex vaginata	(sheathed sedge)
Cornus canadensis	(bunchberry)
Equisetum arvense	(common horsetail)
Calamagrostis canadensis	(bluejoint)
Platanthera obtusata	(one-leaved rein-orchid)
Rubus pubescens	(trailing raspberry)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feather moss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Rhytidiadelphus triquetrus	(electrified cat's tail)
Dicranum polysetum	(wavy-leaved moss)
Peltigera aphthosa	
Sphagnum squarrosum	

SOIL AND SITE:

Slope Gradient (%): 1 (0-2)
Soil Classification: Terric Humisol
Soil Drainage: poorly

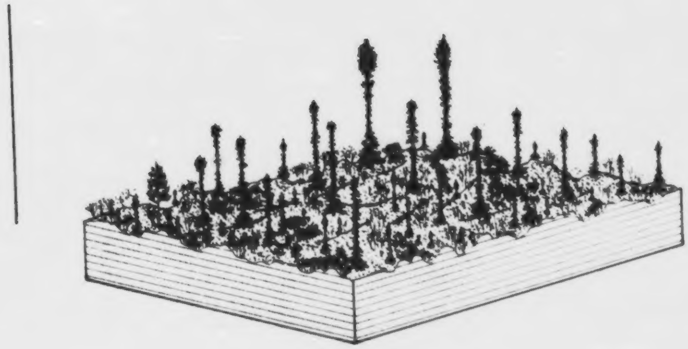
COMMENTS:

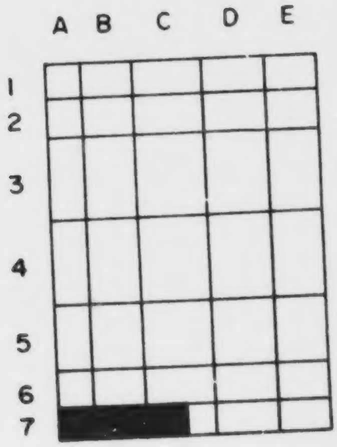
Limited data due to rarity of ecosystem

SBSh/09 BLACK SPRUCE - SPHAGNUM

BIOGEOCLIMATIC UNIT: SBSh

ECOSYSTEM UNIT: SBSh/09; Picea (mariana) - Sphagnum; SBSh: Black spruce - sphagnum ecosystems.





ECOLOGICAL MOISTURE REGIME: subhydric

ECOLOGICAL NUTRIENT REGIME: oligotrophic
- submesotrophic
(- mesotrophic)

IMPORTANT ENVIRONMENTAL FEATURES:

Slope Position: level - depression
Slope Gradient (%): 0.4 (0-2)
Parent Material: organic
Watertable: close to surface

DISTRIBUTION: common

SBSh/09 BLACK SPRUCE - SPHAGNUM

VEGETATION:

Tree Layer: 15% cover; open stands, usually clumped

Picea mariana	(black spruce)

Shrub Layer: 65% cover; moderate cover of regeneration

Picea mariana		) · regeneration
[*Pinus contorta*	(lodgepole pine)]	)
Betula glandulosa	(scrub birch)	) - characteristic dominants
Ledum groenlandicum	(Labrador tea)	)
Salix athabascensis	(Athabasca willow)	
Salix myrtillifolia	(bilberry willow)	
[*Rosa acicularis*	(prickly rose)]	
[*Salix* spp.	(willows)]	

Herb Layer: 60% cover;

Carex aquatilis	(water sedge)	) - characteristic dominants,
Carex rostrata	(beaked sedge)	) either singly or together
Vaccinium oxycoccos	(bog cranberry)	
Smilacina trifolia	(three-leaved false Solomon's-seal)	
Vaccinium vitis-idaea	(lingonberry)	
Carex spp.	(sedges)	
[*Drosera rotundifolia*	(round-leaved sundew)]	
[*Calamagrostis canadensis*	(bluejoint)]	
[*Cornus canadensis*	(bunchberry)]	

Moss Layer: 95% cover

Sphagnum fuscum	(common brown sphagnum)	) - characteristic dominants
Sphagnum capillaceum	(common red sphagnum)	)
Tomenthypnum nitens	golden fuzzy fen moss	
Aulacomnium palustre	ribbed bog moss	
Pleurozium schreberi	(red-stemmed feather moss)	
[*Sphagnum* spp.	(sphagnums)]	
[*Polytrichum strictum*]		

SOIL AND SITE:

Soil Classification: Fibrisol, Mesisol, and Humisol
Coarse Fragments (%): 0
Soil Drainage: very poorly
Rooting Depth: 30 (13-40)
Humus Form: Histomor, Histomoder and Saprimull
pH Humus: 6.2

7.1.1. Discussion

Nine associations have been described in the SBSh subzone. The ranges of moisture and nutrient regimes occupied by these associations are represented in Figure 7.1.

The generalized position of each association within a catchment area is represented by Figure 7.2. Steep slopes and subdued topography are both common in this subzone.

The most common associations in the SBSh are the SBSh/01 and SBSh/04. Together these associations cover approximately 50% of the subzone. The SBSh/03, SBSh/05, and SBSh/08 are all rare or relatively uncommon associations, and together with the SBSh/07 cover less than five percent of the subzone.

Seral stands are common in this subzone. Early successional stages often consist of very dense lodgepole pine or Douglas-fir stands, especially on mesic or drier sites. In dense stands, there is often very little understory vegetation except for a thick carpet of feather mosses. As the canopy cover decreases, understory vegetation is often dominated by grass species (usually Calamagrostis rubescens). Seral stages on wetter sites are often mixed stands of lodgepole pine, trembling aspen, Douglas-fir and hybrid white spruce.

8.0 SILVICULTURAL AND TIMBER MANAGEMENT INTERPRETATIONS

8.1 Introduction

The primary aim in developing this ecosystem classification system is to provide a systematic framework for forest management, a framework to be used as a basis for organizing knowledge about forest ecosystems. This means that basic ecological knowledge, applied research results, and past operational experience can be combined and applied to the same units. Improved management prescriptions for forest activities can then be made, based on an evaluation of these factors at a biogeoclimatic (zone or subzonal) level, rather than by geographical or forest district area. For example, organizing knowledge on the zonal or subzonal level may be useful in developing seed collection zones or general planning operations. Knowledge of ecosystem units, however, can be applied to more direct operational activities. In this manual only the more direct operational interpretations are considered.

Since ecosystem classification organizes and integrates a number of factors, it can be a valuable tool for a wide variety of interpretative uses, including, silviculture and timber management, engineering operations, range management, and wildlife management. In this first approximation we have concentrated on silviculture and timber management. Range interpretations have not been incorporated because of the low level of range activity within the subzones studied. Wildlife interpretations have also been rare. It was felt that the use of habitat by wildlife is often more site-specific than ecosystem-specific. Occasionally, mention is made where conflict with wildlife use by forest managers may occur. An unpublished Ministry of Forests report by Hazelwood (1983) discusses in detail the distribution of, and use by, selected ungulates in the various ecosystem associations in the SBSh subzone.

Engineering interpretations are not dealt with in this manual because of a lack of detailed information based on soil units. Consequently, these interpretations are not easily incorporated into the adopted framework. However, engineering interpretations are made in another Ministry of Forests publication (McLeod and Price 1983) and the appropriate ecosystem units are referenced where possible.

It is important to understand how the interpretations were made and how they should be used. A co-operative approach was adopted by the Ecology, Timber, and Silviculture sections, Prince George Region, in order to develop state-of-the-art treatments for the ecosystem units. Several office sessions and field trips (which included district staff) served as the basis for the development of these interpretations.[1]

Wherever possible, a number of options for a particular operational activity have been indicated. However, the authors stress that these recommendations are not absolute but, rather, they are generalizations that will serve as a constructive guide for management activities. The information presented should enable the forest manager to make rational decisions by considering all options. The final decision on a specific prescription, however, cannot be made solely on the information presented in this manual.

The interpretations are split into two sections: timber; and silviculture. Timber interpretations address harvesting system, time of year for harvesting, and other constraints or hazards associated with harvesting timber from the particular ecosystem. Silvicultural interpretations deal with species selection, stock size, stocking densities, site preparation, brush hazard, regeneration, and stand tending.

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[1] It should be noted, however, that interpretations for the ICHb biogeoclimatic subzone were made by the Ecology Section, Nelson Forest Region, with some minor modifications (after consultation) by the Prince George Ecology section.

It must be emphasized that these interpretations, although based on well understood trends involving sound ecological principles, represent the state-of-the-art. Consequently, they will be subject to revision as our knowledge increases. Use of this manual will be the best method of testing and revising our current knowledge, so that future revisions will include more confident recommendations.

8.2 Definitions and Rationale

8.2.1 Management Objectives

Rotation lengths and piece sizes are indicated in this section primarily as a guide for planning purposes. They are, however, based on little data.

If the economic or site constraints are such that the removal of timber is not presently justifiable, the term "non-commercial" is used. This term implies that under certain future conditions, such ecosystems may potentially be used; ecosystems that seem to have no potential are termed "non-productive". These non-commercial and non-productive sites should be avoided, but if small inclusions are harvested within a larger, more productive unit, managers will need to develop their own prescriptions.

The term "salvage before rehabilitation" means that the stand should be "high-graded", i.e., any economic volumes should be retrieved prior to any rehabilitation activities.

8.2.2 Logging Method

Three types of logging methods were considered in the development of interpretations: clearcut*[1], 2 pass system* (shelterwood), and seed tree*. Factors considered in determining the appropriate logging method were: present stand composition including regenerating species; silvics and ecology of desirable species; and the potential for moisture deficits over the growing season on the particular ecosystem.

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[1] all terms marked * are defined in Appendix 10.6.

8.2.3 Recommended Harvesting System

This refers to the use of conventional logging* (rubber-tired or tracked skidding*), a low ground pressure system*, or a cable system*. No attempt was made to subdivide these options into associated equipment packages as such options are left to the discretion of the user. However, in a limited number of ecosystem units, horse logging or use of a small scale cable system is mentioned, mainly as a strategy to help the user protect certain critical visual corridors.

The primary reason for use of different logging systems is the preservation of site productivity.

8.2.4 Seasonal Constraints

There are three options considered: summer (S), winter (W), and none. Summer harvesting is restricted to the period between (but not including) spring break-up and the first snowfall. Winter harvesting should preferably take place when a 20 cm snowpack or frozen ground is present. For the 'none' option, harvesting can occur at any time of year except for spring break-up. Reasons that harvesting on certain ecosystems is limited to the winter months include prevention of site degradation due to soil compaction, poor bearing strength (trafficability) and reduction of erosion and mass wastage. Reasons that harvesting on certain ecosystems is limited to the summer include the promotion of natural regeneration and the need for clean logging practices.

8.2.5 Slope Classes

This section enables the identification of particular ecosystems that may require a different logging method due to slope constraints. In this report the various slope classes are based on McLeod (1983).

8.2.6 Other Constraints

Constraints considered here are those that could potentially lead to site degradation (i.e. soil compaction, soil erosion, heavy rainfall, or high water table); those that will restrict plantation establishment (i.e. high water table, frost heaving, moisture deficit, or deer browse); those that will affect tree growth (i.e. snowbreak, cold soil, windthrow, or root rot and other pathogens); and those that might conflict with other resource uses (wildlife habitat, fisheries, recreation).

The effects of most of these constraints on forest management is obvious. Two, however, require further discussion.

Where there is a windthrow hazard, managers will need to exercise care in manipulating the unit. They may need to consider juvenile spacing early in the rotation or to avoid commercial thinning. Snow-break is mentioned as a constraint in all units of the ICHb. The forest manager should be aware that secondary pathogen attack or lower plantation performance of certain species as a result of snow-break might be expected in this subzone.

Where any constraint is active, site prescriptions should always be carefully developed so that site productivity losses are minimized.

8.2.7 Brush Hazard

Brush competition is divided into five classes: low, moderate, high, very high, and extreme. While these classes are not comparable to any known standard, they should allow the user to assess which sites have potential to become problem brush sites. The ratings are based on species present, moisture conditions for the unit, and past experience following harvesting of these sites.

8.2.8 Site Preparation

Mechanical site preparation or prescribed burning are the tools currently available for site preparation. They are sufficiently diverse that with proper use they will enable the promotion of natural seedlings, advanced regeneration, or planted seedlings. Appropriate combinations of site preparation techniques are recommended for each ecosystem unit. The factors considered in determining site preparation guidelines for any ecosystem unit are: the protection of the nutrient pool in both the organic and mineral substrates; the amelioration of soil temperature; the removal of excessive fuel loadings; limiting of brush competition; the establishment of good stands; the preparation of a proper seedbed, and the technical limitations of the site preparation equipment.

The term "remove L horizon" means that a prescribed burn should be sufficiently light that only the litter is removed. The F and H horizons (which contain partially or fully decomposed residues) should remain intact. A possible method to achieve this is an early spring burn.

8.2.9 Species Selection

All tree species selection recommendations are based on the silvics of each species[1], together with site factors such as ecological moisture and nutrient regime, soil texture, soil drainage and rooting depth. Species known to have occurred (seral or climax) in any ecosystem unit, as well as potential vegetation competition or pathogen susceptibility, were also considered. Non-ecological factors considered were rotation length and present day commercial utilization of the species.

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[1] Tree species symbols used in this chapter are those listed in the Inventory Manual. Inventory Branch, Ministry of Forests, Victoria, B.C.

Western redcedar is recommended as an acceptable regenerating species in order to maintain the productive humus forms in the Interior Cedar - Hemlock zone. It is estimated that approximately 300 stems/hectare will naturally regenerate under current forest management practices. The manager should therefore be aware that this natural regeneration is desirable and should reduce planting densities accordingly.

8.2.10 Stock Type for Planting

All stock type dimensions and shoot/root ratios were provided by Regional Silviculture staff using target stock type standards that have been developed by them. The rationale behind the selection of a specific type stock is as follows. In general, on favourable sites, the silviculturist has a large degree of flexibility in choosing a stock type to plant. On severe sites, where brush or moisture deficits limit plantation establishment and growth, the silviculturist should order a very specific stock type. For example, a tall, sturdy, well balanced seedling can withstand the rigours of severe brush competition, while a short seedling with good root volumes would be best for planting on dry sites that have significant moisture deficits. The term "use large planting stock" refers to the planting of larger than average stock types. Such stock types are recommended on sites that have high to severe brush competition.

8.2.11 Stocking Density

All stocking densities reflect the required number of stems per hectare at the free-growing stage of the plantation, and not the number of stems planted. Stocking densities for the various species considered for each ecosystem association are based on the expertise and experience of the Regional Silviculture section. Explanations of the recommended stocking densities are included in "Stocking Standards and Species Selection Guidelines", issued as Standard Operating Procedures by the Prince George Regional manager (May, 1982).

8.2.12 Regeneration Delay

Regeneration delay is defined as the time period after harvesting and site preparation that is required for sufficient stocking density of the desired species to be obtained.

Natural regeneration strategies require a certain time to elapse before sufficient stocking densities are reached. The longer the time period indicated for regeneration delay, the more likely the site will have a serious brush hazard by the time sufficient stocking density is established. For natural regeneration, the times given are based on past experience in the area.

For planted seedlings there is usually no regeneration delay, so that planted stock can gain all possible advantage over competing brush species. Where a regeneration delay is indicated for planted stock, some growth of vegetation prior to planting is likely to be advantageous to the planted stock, acting as shade protection.

8.2.13 Time to Achieve a Free-Growing Seedling

"Free to grow" is defined as the time period required to obtain a certain dimension of stock that can be considered free growing (i.e. unencumbered by any factors other than site productivity constraints). The time given is in addition to that stated for the regeneration delay. Stock dimensions at the free-to-grow age are defined in the guideline references in Section 8.2.11. By recommending differing stock types for the various species on each unit, the same "free-to-grow" time can be listed for all species on the unit.

8.2.14 Stand Tending

Stand tending activities considered in this report include brushing and weeding*, commercial thinning*, seed tree control*, sanitation spacing*, and juvenile spacing*. All associated parameters in the stand tending section of this report are based on the expertise of Regional Silviculture personnel. There is little information on the proper timing of stand tending techniques for most of the ecosystem units in the manual. More specific times or stocking densities will be published as data become available. For the present, general comments on stand tending activities are given in the "Silvicultural Application" section of each unit.

8.3 Interpretations

8.3.1 ICHb Subzone

ICHb/01 THIMBLEBERRY - LADY FERN

SILVICULTURE INTERPRETATIONS

Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Regeneration Options							Stand Tending	
								Natural		Artificial						
								Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-snow-break	-broadcast burn (remove L and F horizons)	Fd	3	5				Fd	1.5/1	5	20	700		
				Sx	3	5				Sx	1.5/1	5.5	22	1100		
				Cw				Cw	300							
				Pw				Pw	300							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	W	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Fd or Sx peeler logs on a 75 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- expect and maintain natural regeneration of Cw and Pw to augment planted stock.
- expect Cw and Pw to be pole size at 40 years; look at a possible commercial thin at this time.
- a brushing and weeding program will probably be required.
- use large planting stock.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large stock types should be planted immediately after harvesting; the use of herbicides to control brush may also be required.
- Pw blister rust may kill stems within 40 years but by this time Pw will likely be pole size and perhaps of an economical size to justify a commercial thin.
- the extremely high snowpack in the subzone may damage young Fd.

ICHb/02 FALSEBOX - PRINCE'S PINE

SILVICULTURE INTERPRETATIONS

Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Regeneration Options							Stand Tending	
								Natural		Artificial						
								Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	mod.	-snow-break	- do not burn - scarification with Leno or drag on slopes <30%	Fd Pw	5 5	10 10		Fd Pw	700 300	Fd	1.5/1	5	20	900		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Fd sawlog on a 85 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- if natural regeneration unsuccessful, plant Fd.
- complete planting by mid June.
- may need a juvenile spacing program approximately 10 years after natural regeneration is established.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting; sites should therefore be inspected at three years to determine if any further treatments are required.
- Pw blister rust may kill stems within 40 years but by this time Pw will likely be pole size and perhaps of an economical size to justify a commercial thin.
- the very high snowpack in this subzone may damage young Fd.

ICHb/03 RED TWINBERRY - WILD SARSAPARILLA

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	mod.	-snow-break	-broadcast burn (remove L and F horizons)	Fd Sx Pw Cw	3 3	8 8		Pw Cw	300 300	Fd Sx	1.5/1 1/1	5 7	20 30	900 1100		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Fd or Sx sawlogs on a 75 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- expect and maintain natural regeneration of Pw and Cw.
- Cw and Pw will likely be pole size 40 years after plantation establishment; can look at a possible commercial thin at this time.
- complete planting by mid-June.
- use large planting stock.
- may need a juvenile spacing program approximately 10 years after planting.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting; sites should be inspected at three years to determine if any further treatments are required.
- Pw blister rust may kill stems within 40 years but by this time Pw will likely be pole size and perhaps of an economical size to justify a commercial thin.
- the extremely high snowpack in this subzone may damage young Fd after "free to grow" stage has occurred.

ICHb/04 BLACK HUCKLEBERRY - SPINY WOOD FERN

SILVICULTURE INTERPRETATIONS

								Regeneration Options								Stand Tending	
								Natural		Artificial							
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-snow-break	-broadcast burn (remove L horizon)	Sx	1	5				Sx	1/1	7	30	1300		
				Fd	1	5				Fd	1/1	6	25	1100		
				Pw				Pw	300							
				Cw				Cw	300							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Sx or Fd sawlogs on a 75 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- expect and maintain natural regeneration of Cw and Pw to augment planted stock.
- expect Cw and Pw to be pole size at 35 years; can look at a possible commercial thin at this time.
- complete planting by mid-June.
- use large planting stock.
- may need a juvenile spacing program approximately 10 years after planting.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large planting stock should be planted immediately after harvesting.
- the use of herbicides to control brush may be required.
- Pw blister rust may kill stems within 40 years but by this time Pw will likely be pole size and perhaps of an economical size to justify a commercial thin.
- the very high snowpack in this subzone may damage young Fd.

ICHb/05 RED-OSIER DOGWOOD - COMMON HORSETAIL

SILVICULTURE INTERPRETATIONS

Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Regeneration Options							Stand Tending	
								Natural		Artificial						
								Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-snow-break -high windthrow hazard -high fish and wildlife values	-broadcast burn (remove L and F horizons	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- manage for Sx peeler log on a 75 year rotation.
- salvage before rehabilitation.
- protect the high fisheries and wildlife values.

II. Silviculture Applications:
- expect and maintain natural regeneration of Cw.
- planting can take place at any time of the growing season.
- use large planting stock.
- will likely need a juvenile spacing program approximately 10 years after planting.
- Cw will likely be pole size at 40 years, therefore, consider removing Cw as part of any commercial thinning project.

III. Silviculture Problems:
- very high brush competition will require a seed tree control program and inspection of harvested sites at time periods 2 and 4 years after planting; these inspections may indicate a need for further conifer release projects.
- if commercial thin is undertaken, extreme care must be taken to minimize windthrow.

ICHb/06 SKUNK CABBAGE - LEAFY MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-snow-break -high watertable	-broadcast burn (remove L and F horizons) and use a mounding technique	Sx Cw	1	5		Cw	700	Sx	1/1	7	30	600		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- manage for Sx sawlog on a 75 year rotation.
- manage for Cw poles.
- this association will likely be an inclusion within a treatment unit, because it generally is small in size.

II. Silviculture Applications:
- expect and maintain natural regeneration of Cw.
- plant after water table drops below ground level and put Sx on drier microsites (i.e. mounds).
- use large planting stock.
- may need a juvenile spacing program approximately 10 years after planting.

III. Silviculture Problems:
- this association is critical to the control of runoff and stream flow.
- water table will likely rise above the ground surface in the spring causing seedling mortality.
- herbicide use to control brush competition may conflict with the need to protect fish and wildlife values.
- high brush competition will likely occur within two years of harvesting, so large stock types should be planted immediately after harvesting.

8.3.2 ICHj Subzone

ICHj/01 FALSE AZALEA - QUEEN'S CUP

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low/ mod.	-possible cankers	-broadcast burn (remove L horizon) or windrow and burn	Fd Sx Pl Cw	3	5		Cw	300	Fd Sx Pl	1.5/1 1.5/1 2/1	5 5.5 3	20 22 12	900 1100 1500	30	700

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30 31-40 41-55 56+	W W W S or W	conventional or l.g.p. l.g.p. or D6 l.g.p. cable

COMMENTS

I. Management Objectives:
- manage for Fd or Sx peeler logs on an 80 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- complete planting by mid-June.
- Cw will likely be pole size at 40 years, therefore consider removing merchantable Cw as part of any commercial thinning project.
- a juvenile spacing project may be required at 15-20 years after planting but retain as much of a Cw component as possible.

III. Silviculture Problems:

- the humus forms on these sites are thin and removal of more than the litter layer will probably seriously affect site productivity.

ICH j/02 DOUGLAS-FIR - FALSEBOX

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	- possible cankers	- do not burn	Pl Fd	10 10	7 7		Pl Fd	1300 700							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- non-commercial at this time.
- leave sites until future technological improvements occur.
- sites will probably be inclusions within a treatment unit.

II. Silviculture Applications:
- promote a Fd and Pl mixture on the sites.
- possible to direct seed Pl over the site but should check rodent populations first.
- practice sanitation procedures on Pl when necessary.

III. Silviculture Problems:
- pine beetle and dwarf mistletoe can be problems on Pl along with canker infestations on Fd.
- monitor rodent populations and consider their impact when deciding on stocking levels.

ICHj/03 HEMLOCK - MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low		-preserve humus layer. -light broadcast burn in early spring or windrow and burn on moderate slopes	Fd	4	5				Fd	1.5/1	5	20	900	30	700
				P1	4	5				P1	2/1	4	15	1300	15	1200

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for sawlogs on an 80 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- plant within three weeks of snow melt and in moist micro-sites.
- assess presence of dwarf mistletoe in P1 types and apply the necessary sanitation practices.

III. Silviculture Problems:
- expect mid-rotation snow break if planting P1.

ICHj/04 OAK FERN - STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low/ mod.	-fine-textured moraines may be subject to compaction and and may create windthrow problems	-broadcast burn (remove L horizon)	Fd Sx Cw	1 1	5 5		Cw	300	Fd Sx	1/1 1/1	5 5.5	20 22	1100 1300	30	700

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Fd sawlogs on a 70 year rotation and Sx sawlogs on an 80 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- if considering a commercial thin, plant an additional 200 stems/ha.
- plant Sx on fine-textured sites and Fd on coarser sites.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting so sites should be inspected at three years to determine if any further treatment is required.
- windthrow potential and compaction problems may be of concern on fine-textured moraines.

ICHj/05 DEVIL'S CLUB - OAK FERN

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-high windthrow hazard -soil compaction	-burn to remove litter horizon	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	W	l.g.p. or D6
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on an 80 year rotation and Sx peeler logs on a 100 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- if considering a commercial thin, plant an additional 200 stems/ha.
- planting can take place anytime throughout growing season.
- use large planting stock.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large stock types should be planted immediately after harvesting.
- do not commercial thin if windthrow is considered to be a high hazard on the site.

ICHj/06 DEVIL'S CLUB - HORSETAIL

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- high watertable														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.
- very rare occurrence.

ICHj/07 BLACK SPRUCE - SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- high watertable - cold, unproductive sites														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.

ICHj/08 SKUNK CABBAGE - SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- high watertable														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.
- very rare occurrence.

8.3.3 ICHk Subzone

ICHk/OI(a) OAK FERN - STEP MOSS, COARSE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	mod.	-windthrow in Sx	- windrow and burn or light broad-cast burn	Fd	1	5				Fd	1/1	6	25	900	60	600
				Sx	1	5				Sx	1.5/1	5.5	22	1100		
				Cw				Cw	300							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S	conventional or D6
	31-40	S	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

II. Silviculture Applications:
- do not remove humus layers; burn lightly or mix with mineral soil.
- accept and maintain Cw component.
- possibly fertilize after commercial thinning.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting so sites should be inspected at three years to determine if any further treatment is required.

COMMENTS

I. Management Objectives:
- manage for Fd or Sx peeler logs on an 85 year rotation.

ICHk/OI(b) OAK FERN - STEP MOSS, FINE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	mod.	-windthrow in Sx -frost heaving -soil compaction	-broadcast burn	Sx Cw	1	5		Cw	300	Sx	1.5/1	5.5	22	1100		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30 31+	W S or W	conventional or l.g.p. cable

COMMENTS

I. Management Objectives:
- manage for a Sx sawlogs on an 80 year rotation.

II. Silviculture Applications:
- do not remove humus but reduce hazard on site by light burning or by clean logging.
- no mechanical treatments should be allowed.
- accept Cw and maintain Cw component.
- if considering a commercial thin, plant an additional 200 stems/ha and juvenile space.
- possibly fertilize after commercial thinning.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting so sites should be inspected at three years to determine if any further treatment is required.

ICHk/02 HEMLOCK - LICHEN

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging			-do not burn													

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- non-commercial at this time.

II. Silviculture Applications:
- if this ecosystem is contained within a treatment unit, clearcut to remove Hw seed source.
- planting is probably not justified due to the very low productivity of the sites.
- let sites regenerate naturally.

III. Silviculture Problems:
- very fragile ecosystem with low productivity.
- will likely take a long time to regenerate if logged, so could have a large impact if located in a visual corridor.
- do not burn.

ICHk/03 CEDAR - MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-moisture deficits	-once rehabilitated, site should have light spring burn to remove litter	Fd Cw	1	10		Cw	300	Fd	1/1	6	25	900		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	S or W	medium cats
	41-55	W	l.g.p.
	55+	S	cable

COMMENTS

I. Management Objectives:
- manage for Fd sawlogs on a 100 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- during site preparation, attempt to retain F and H horizons.
- accept and maintain Cw component.
- if possible, attempt to obtain natural Fd regeneration.
- plant before mid-June.
- site does not justify any intensive silviculture treatments under present-day criteria.

III. Silviculture Problems:
- these sites occupy very steep sidehills where access is difficult.
- moisture deficits are enhanced by the steepness of these sites.
- control of burning will be very difficult.

ICHk/04 HEMLOCK - STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-frost heaving -moisture deficits -soil compaction	-light spring burn to remove litter	Fd	1	5				Fd	2/1	4	15	700		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30 31+	W S or W	conventional or l.g.p. cable

COMMENTS

I. Management Objectives:
- usually found with 01(b) association. Manage for Fd sawlogs on a 90 year rotation.
- very rare association.

II. Silviculture Application:
- plant before mid-June.

III. Silviculture Problems:
- when this ecosystem does occur, it is usually on the upper slope or crest position.
- this association occurs on a thin lacustrine veneer over bedrock and is subject to serious erosion if not harvested carefully.

ICHk/05 BRAMBLE - STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-possible moisture deficit over dry summers -soil compaction and frost heaving on lacustrine sites	-windrow and burn or mix duff with mineral soil on non-lacustrine soil -broadcast burn on lacustrine	Fd Sx Cw	1 1	5 5		Cw	300	Fd Sx	1.5/1 1.5/1	5 5.5	20 22	700 900	50	600

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
  - manage for Fd sawlogs on a 65 year rotation for non-lacustrine soil types.
  - manage for Sx sawlogs on an 80 year rotation for lacustrine soil types (these are very rare).

II. Silviculture Application:
  - accept and maintain Cw component.
  - complete planting by mid-June.
  - if considering a commercial thin, plant an additional 200 stems/ha.

III. Silviculture Problems:
  - important to determine if this association occurs on lacustrine or non-lacustrine material in order to ensure minimization of serious soil compaction on lacustrine types.

ICHk/06(a) DEVIL'S CLUB - OAK FERN, COARSE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-windthrow in Sx	-broadcast burn (remove L & F horizons) or windrow and burn	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-31	W	conventional or l.g.p.
	31-40	W	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on a 65-70 year rotation.

II. Silviculture Application:
- accept and maintain Cw component.
- use large planting stock.
- if considering a commercial thin, plant an additional 200 stems/ha.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large stock types should be planted immediately after harvesting.

ICHk/06(b) DEVIL'S CLUB - OAK FERN, FINE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-high windthrow hazard -soil compaction	-broadcast burn in mid-summer	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30 31+	W S or W	conventional or l.g.p. cable

COMMENTS

I. Management Objectives
- manage for Sx sawlogs on a 65-70 year rotation.

II. Silviculture Application:
- accept and maintain Cw component.
- use large planting stock.
- windthrow hazard negates commercial thinning options.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large stock types should be planted immediately after harvesting.

ICHk/07(a) BLACK TWINBERRY - HORSETAIL, FLUVIAL PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-cottonwood competition -water table near surface -frost pockets -high fish and wildlife value -high erosion potential	-broadcast burn (remove L and F horizons)	Sx Cw	1	3		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
  - manage for Sx sawlogs on a 65-70 year rotation.
  - protect the high fisheries and wildlife values.

II. Silviculture Application:
  - remove Hw and cottonwood seed source.
  - accept and maintain Cw component.
  - plant in mid-summer after water table drops.
  - use large planting stock.
  - juvenile spacing or conifer release of Sx from cottonwood overstory likely required at age 10 years.
  - borders SBSg subzone.

III. Silviculture Problems:
  - very high brush competition will require a seed tree control program and inspection of harvested sites at time periods 2 and 4 years after planting.
  - these inspections may indicate a need for further conifer release projects.

ICHk/07(b) BLACK TWINBERRY - HORSETAIL, LACUSTRINE PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after thinning
clearcut	very high	-slope instability -cottonwood competition -water table near surface -frost pockets -soil compaction -high erosion potential -high fish and wildlife values	-broadcast burn (remove L-F horizons) -mounding technique should be used to encourage plantation performance	Sx Cw	1	3		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
  - manage for Sx sawlogs on a 70 year rotation.
  - protect the high fisheries and wildlife values.

II. Silviculture Application:
  - remove Hw and cottonwood seed source.
  - accept and maintain Cw component.
  - plant in mid-summer after water table drops.
  - use large planting stock.
  - juvenile spacing or conifer release of Sx from cottonwood overstory likely required at age 10 years.
  - borders SBSg subzone.

III. Silviculture Problems:
  - very high brush competition will require a seed tree control program and inspection of harvested sites at time periods 2 and 4 years after planting.
  - these inspections may indicate a need for further conifer release projects.

ICHk/08.1 HEMLOCK - HORSETAIL - STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low/ mod.	-high water table -cold soils -soil compaction -high windthrow -poor trafficability	-mounding technique	Sx	1	5				Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on a 100 year rotation.

II. Silviculture Application:
- use large planting stock.
- use ploughing or mounding techniques if trafficability is not a problem (i.e., if soil is frozen), otherwise plant on existing mounds.

III. Silviculture Problems:
- cold soils and high water table lower the productivity of these sites.

ICHk/08.2 HEMLOCK - HORSETAIL - SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- high watertable - cold soils														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives
- non-commercial and will require considerable investment to improve productivity.

ICHk/09 MOUNTAIN ALDER – SKUNK CABBAGE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- high watertable - unproductive ecosystems for forestry														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.

ICHk/IO PINE - SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-high windthrow -soil compaction -frost heaving -high water table	-frost will not usually penetrate soil so mechanized site preparation will be unreliable	Sx	1	5				Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- non-commercial at this time.

II. Silviculture Application:
- this association will likely be an inclusion within a treatment unit; if so, remove seed sources of Hw and alder and plant Sx on drier microsites (ie. mounds).
- water table will likely rise above the ground surface in the spring causing seedling mortality.
- use large planting stock.

III. Silviculture Problems:
- is critical to the control of runoff and streamflow.

8.3.4 ICHf Subzone

ICHf/OI(a) DEVIL'S CLUB - OAK FERN, COARSE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high		-broadcast burn (remove L and F horizons) or windrow and burn or brown and burn	Sx	1	5				Sx	1/1	7	30	1100		
				Fd	1	5				Fd	1/1	5	20	1100	30	700
				Cw				Cw	300							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	W	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for sawlogs on a 75 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- use large planting stock.
- plant Fd on drier microsites.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting, so large stock types should be planted immediately after harvesting.

ICHf/OI(b) DEVIL'S CLUB - OAK FERN, FINE-TEXTURED PHASE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	high	-high windthrow hazard -soil compaction -cold soil -frost heaving	-broadcast burn (remove L and F horizons) or use mounding technique	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30 31+	W S or W	conventional or l.g.p. cable

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on a 75 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- use large planting stock.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting, so large stock types should be planted immediately after harvesting.
- do not consider commercial thinning because of the high windthrow hazard.

ICHf/02 HEMLOCK – BLACK HUCKLEBERRY

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-mod. erosion hazard because of shallow soil over bedrock -moisture deficits	-do not burn	Pl Fd	3 3	8 8				Pl Fd	2/1 1/1	3 6	12 25	1300 900		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	convential
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- non-commercial at this time but will likely be an inclusion within a treatment unit.

II. Silviculture Applications:
- may require a juvenile spacing program in Pl stands.
- complete planting before mid-June.

III. Silviculture Problems:
- serious moisture deficits can be expected throughout the growing season.

ICHf/03 PRINCE'S PINE – STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-mod. erosion hazard because of steep slopes	-broadcast burn (remove L horizon).	Fd Pl Cw	3 3	7-10 7-10		Cw	300	Fd Pl	1.5/1 2/1	5 3	20 12	700 1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional
	31-40	S or W	medium cats
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
   - non-commercial at this time but will likely be an inclusion within a treatment unit.

II. Silviculture Applications:
   - accept and maintain Cw component.
   - plant within two weeks of snow melt and the thawing of frozen soil.

III. Silviculture Problems:
   - moisture deficits can be expected throughout the growing season.

ICHf/04 OAK FERN - STEP MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low to mod.		-broadcast burn (remove L and F horizons) or windrow and burn	Fd Sx Cw	1 1	5-7 5-7		Cw	300	Fd Sx	1.5/1 1.5/1	5 5.5	20 22	700 900	at c.c.* at c.c.*	600 600

*c.c. = crown closure

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	W	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for sawlogs on a 70 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- if considering a commercial thin, plant an additional 200 stems/ha.
- complete planting before mid-June.

III. Silviculture Problems:
- moderate brush competition will likely occur within three years of harvesting, so sites should be inspected at three years to determine if any further treatment is required.

ICHf/05 DEVIL'S CLUB - OSTRICH FERN

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-high windthrow hazard -soil compaction -frost heaving -high water table	-possible use of ripper plough or other mechanical treatment when frost is in the ground	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.
	31-40	W	medium cats
	41-55	W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on a 60 year rotation.
- salvage before rehabilitation.

II. Silviculture Applications:
- accept and maintain Cw component.
- use large planting stock.

III. Silviculture Problems:
- very high brush competition will require a seed tree control program and inspection of harvested sites at time periods 2 and 4 years after planting; these inspections may indicate a need for further conifer release projects.
- site may require treatment with herbicides to control brush.

ICHf/06 MOUNTAIN ALDER – SKUNK CABBAGE

SILVICULTURE INTERPRETATIONS

								Regeneration Options								Stand Tending	
								Natural		Artificial							
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-high windthrow hazard -soil compaction -frost heaving -high water table	-frost won't be driven into soil, so will have access problems -micro-mounding technique required	Sx Cw	1	5		Cw	300	Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- non-commercial at this time but will likely be an inclusion of a treatment unit.

II. Silviculture Applications:
- accept and maintain Cw component.
- plant seedlings on drier microsites (mounds).
- use large planting stock.

III. Silviculture Problems:
- will have a serious problem with access onto these areas; equipment will get stuck repeatedly even in winter; frost will not penetrate soil to give the required support.
- serious windthrow hazard associated with these sites.
- water table may rise above the ground surface causing seedling mortality.

ICHf/07 BLACK SPRUCE – SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- nigh watertable - unproductive sites for forestry														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
   - non-commercial at this time.

SBSh/01 SPIREA – MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
2 pass system	low/ mod.	- deer browse	none	Fd	1	10	60 (protect gene pool)	Fd	1200						at c.c.*	900
				Pl	1	10		Pl	1300							
clearcut	low/ mod.	- moisture deficit		Fd	1	7		Fd	300	Fd	1.5/1	5	25	300	at c.c.*	900
				Pl	1	7		Pl	500							
clearcut with seed tree	low/ mod.	- moisture deficit		Fd	5-10	10	90 (protect gene pool)	Fd	900						at c.c*	900
				Pl	5-10	10		1	900							

*c.c. = crown closure

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
2 pass system or clearcut	0-30	S or W	conventional
	31-40	S or W	medium cat
	41-55	S or W	l.g.p.
	56+	S or W	cable

COMMENTS

I. Management Objectives:
- manage for Fd sawlogs in an 80 year rotation.

II. Silviculture Applications:
- leave 30-50 genetically superior seed trees/ha. if using the seed tree option.
- use the 2-pass system only when visual impact or recreation values warrant (this system recommended for Mt. Robson corridor and Mt. Terry Fox).
- expect natural regeneration of Fd and Pl.
- overstocking of Fd or Pl may occur; if so, may need to juvenile space 10 years after harvesting.

III. Silviculture Problems:
- do not use skidders if adopting the 2-pass system because of soil compaction problems.
- supervision of contractors must be mandatory if the 2-pass system is to work.
- horse logging, small cat or cable system may need to be utilized to protect residual stems.

SBSh/02 PINE – LICHEN

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		- extreme moisture deficit														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commerical at this time:
- eolian deposits are the most common parent materials underlying these sites.
- logging could initiate dune movement.

SBSh/03 DOUGLAS-FIR – LICHEN

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging																

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- reserved for wildlife.
- class 1 wildlife lands.
- represents critical wintering grounds.
- this is a rare association in this subzone and occurs as small pockets on very steep terrain.

SBSh/04 PINE - SOOPOLALLIE

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-deer browse -dwarf mistletoe -high moisture deficits	-drag scarify if winter logged	Pl	5	5		Pl	1300							

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional

COMMENTS

I. Management Objectives:
- manage for Pl sawlog on a 90 year rotation.

II. Silviculture Applications:
- drought level duration could result in serious seedling mortality.
- complete planting by mid-June
- range values are moderate to high on these sites.
- practice dwarf mistletoe control techniques.
- fell all Pl over 1 m to reduce dwarf mistletoe infection of new stand.

SBSh/05 PINE - LABRADOR TEA

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	low	-dwarf mistletoe	-light drag scarify if winter logged	Pl	3	5		Pl	1300	Pl	1/1	6	25	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	S or W	conventional

COMMENTS

I. Management Objectives:
- manage for Pl sawlogs on a 90 year rotation.

II. Silviculture Applications:
- does not justify any silvicultural investment other than drag scarification.
- practice dwarf mistletoe control techniques.

SBSh/06 THIMBLEBERRY - WILD SARSAPARILLA

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seeding /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	mod. to high	-high windthrow hazard -good moose habitat	-broadcast burn (remove L horizon)	Fd	1	5				Fd	1/1	6	25	1100	at*c.c.	600
				Sx	1	5				Sx	1/1	7	30	1300	at*c.c.	600

*c.c.=crown closure

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- manage for Fd sawlogs on a 70 year rotation or Sx sawlogs on an 80 year rotation.
- protect wildlife values.

II. Silviculture Applications:
- seed tree control of alder and aspen.
- complete planting by mid-June.
- use large planting stock.

III. Silviculture Problems:
- high brush competition will likely occur within two years of harvesting so large stock types should be planted immediately after harvesting.
- use of herbicides to help control brush competition may conflict with protection of wildlife values.

SBSh/07 SPRUCE - HORSETAIL

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
clearcut	very high	-high salmon & moose values -high windthrow hazard -high water table	-broadcast burn (remove L horizon) or windrow and burn	Sx	2	5				Sx	1/1	7	30	1300		

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System
clearcut	0-30	W	conventional or l.g.p.

COMMENTS

I. Management Objectives:
- manage for Sx sawlogs on a 70 year rotation.
- protect high fisheries (salmon) and high wildlife values.

II. Silviculture Applications:
- use of herbicides not recommended.
- seed tree control of alder, willow and cottonwood.
- juvenile spacing or conifer release of Sx from cottonwood overstory likely required at age 10 years.

III. Silviculture Problems:
- very high brush competition will require a seed tree control program and inspection of harvested sites at time periods 2 and 4 years after planting.
- these inspections may indicate a need for further conifer release projects.

SBSh/08 BLACK SPRUCE - MOSS

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		-high watertable														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.
- very rare association.

SBSh/09 BLACK SPRUCE - SPHAGNUM

SILVICULTURE INTERPRETATIONS

								Regeneration Options							Stand Tending	
								Natural		Artificial						
Logging Method	Brush Hazard	Other Constraints	Site Preparation	Species Select.	Regen. Delay	Time to Free Growing	% Canopy Removed	Species	Seedling /ha	Species	Shoot/ Root Ratio	Caliper (mm)	Height (cm)	Seedling /ha	Time of Thinning	Stems/ha after Thinning
Avoid logging		-high watertable -unproductive sites for forestry														

TIMBER INTERPRETATIONS

Logging Method	% Slope	Seasonal Constraints	Recommended Harvesting System

COMMENTS

I. Management Objectives:
- non-commercial at this time.

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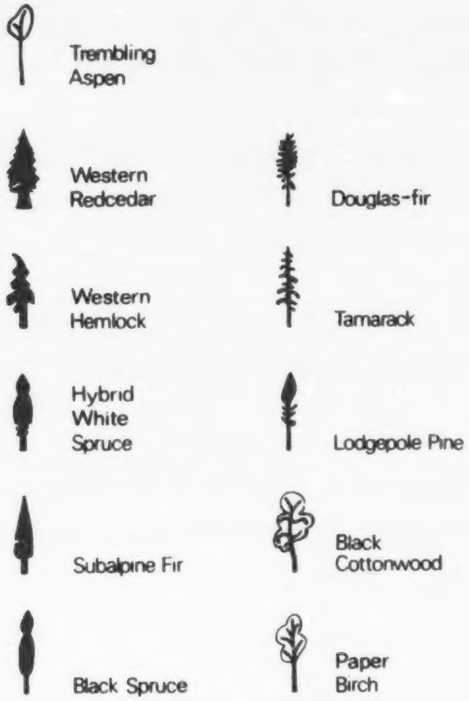
10.0 APPENDIX

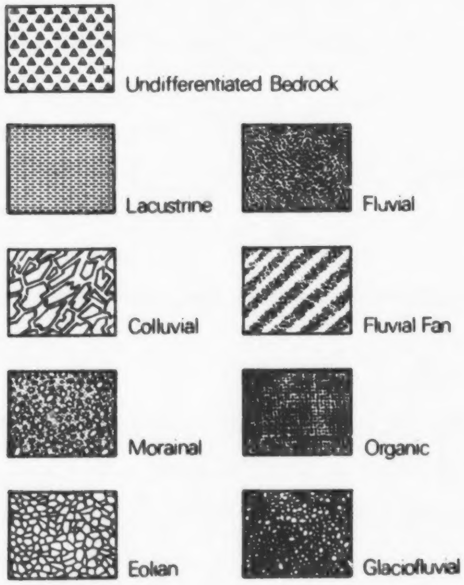
10.1 Keys

10.1.1 Key to Tree Symbols (A) and Parent Material and Bedrock (B) for Toposequence Diagrams

A.

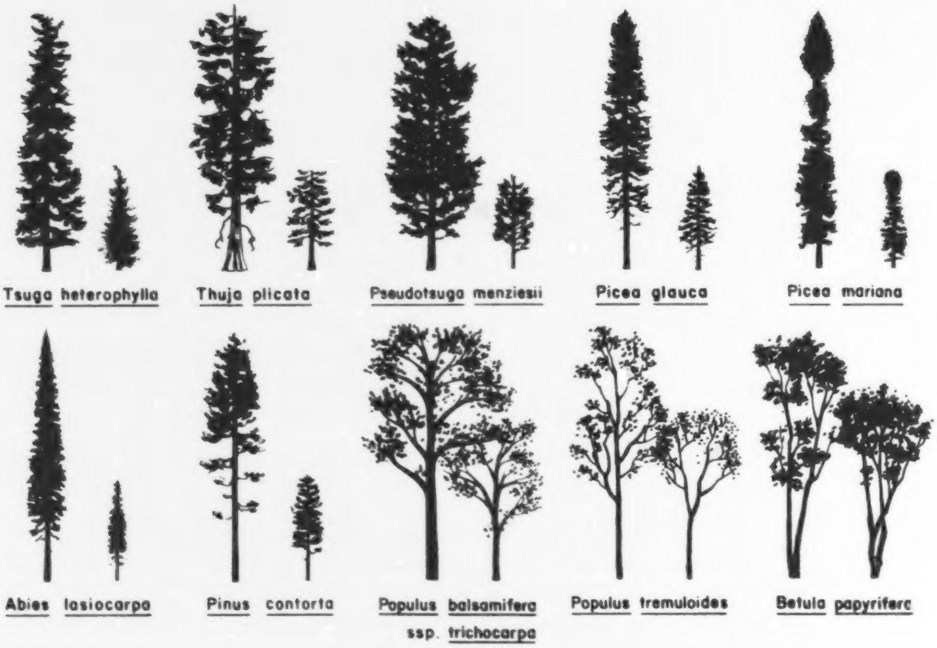

Trembling Aspen
Western Redcedar
Douglas-fir
Western Hemlock
Tamarack
Hybrid White Spruce
Lodgepole Pine
Subalpine Fir
Black Cottonwood
Black Spruce
Paper Birch

B.

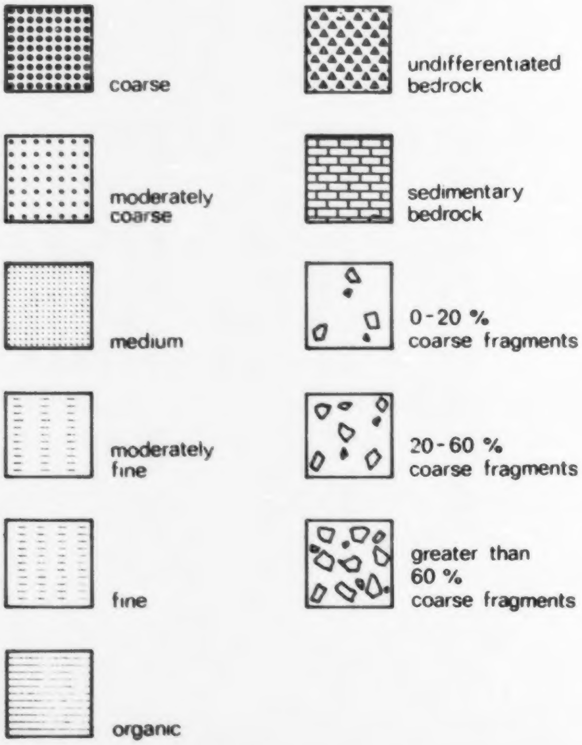

Undifferentiated Bedrock
Lacustrine
Fluvial
Colluvial
Fluvial Fan
Morainal
Organic
Eolian
Glaciofluvial

10.1.2 Key to Tree Symbols (A), and Soil Textures and Bedrock (B), for Ecosystem Unit Diagrams

A.


Tsuga heterophylla
Thuja plicata
Pseudotsuga menziesii
Picea glauca
Picea mariana
Abies lasiocarpa
Pinus contorta
Populus balsamifera ssp. trichocarpa
Populus tremuloides
Betula papyrifera

B.


coarse
moderately coarse
medium
moderately fine
fine
organic
undifferentiated bedrock
sedimentary bedrock
0-20 % coarse fragments
20-60 % coarse fragments
greater than 60 % coarse fragments

10.2 Ecological Moisture Regime Classes

Moisture regime	Defining characteristics	Field recognition characteristics				
	Description	Slope position	Texture	Depth to impermeable layer	Surface humus depth	Slope gradient
XERIC	Water removed very rapidly in relation to supply	ridge crests shedding	very coarse (gravelly S) abundant coarse fragments	very shallow (0.5m)	very shallow	very steep (especially on south aspects)
SUBXERIC	Water removed rapidly in relation to supply					
SUBMESIC	Water removed readily in relation to supply	upper slopes shedding	coarse to mod. coarse (LS-SL) mod. coarse fragments	shallow (1m)	shallow	steep
MESIC	Water removed somewhat slowly in relation to supply	mid-slope normal rolling to flat	moderate to fine (L-SiL) few coarse fragments	moderately deep (1-2 m)	moderately deep	moderate
SUBHYGRIC	Water removed slowly enough to keep the soil wet for a significant part of the growing season; some temporary seepage			deep (2 m)	deep	slight
HYGRIC	Water removed slowly enough to keep the soil wet for most of the growing season; permanent seepage	lower slopes receiving	variable depending on seepage	variable depending on seepage		
SUBHYDRIC	Water removed slowly enough to keep the water table at or near the surface for most of the year	depressions receiving	variable depending on seepage		very deep	flat

10.3 Ecological Nutrient Regime Characteristics

	Oligotrophic A	Submesotrophic B	Mesotrophic C	Permesotrophic D	Eutrophic E
Definition	very poor nutritional status, very small supply of available nutrients	poor nutritional status, low supply of available nutrients	medium nutritional status, medium supply of available nutrients	rich nutritional status, plentiful supply of available nutrients	very rich nutritional status, abundant supply of nutrients
Texture	very coarse	coarse	medium	fine	very fine
Organic Matter Content	low		medium		high
Humus Form	acid mors		mor & moders		moders and mulls
Aeration	low		medium	high	
Soil Temperature		cold	warm		

10.4 Index of Plant Names Used in the Manual

Latin Name	Common Name
Abies lasiocarpa	subalpine fir
Acer glabrum	Douglas maple
Achillea millefolium	yarrow
Actaea rubra	baneberry
Alnus incana ssp. *tenuifolia*	mountain alder
Alnus spp.	alders
Amelanchier alnifolia	Saskatoon
Andromeda polifolia	bog rosemary
Antennaria lanata	wooly pussytoes
Antennaria neglecta	field pussytoes
Apocynum androsaemifolium	spreading dogbane
Arabis holboellii	Holboell's rockcress
Aralia nudicaulis	wild sarsaparilla
Arctostaphylos uva-ursi	kinnikinnick
Arnica spp.	arnicas
Artemisia arctica	mountain sage
Aster ciliolatus	fringed aster
Aster conspicuus	showy aster
Athyrium filix-femina	lady fern
Aulacomnium palustre	ribbed bog moss
Barbilophozia floerkei	
Barbilophozia lycopodioides	common leafy liverwort
Barbilophozia spp.	
Betula glandulosa	scrub birch
Betula papyrifera	paper birch
Brachythecium curtum	
Brachythecium hylotapetum	
Brachythecium spp.	

Calamagrostis canadensis	bluejoint
Calamagrostis rubescens	pinegrass
Calliergon spp.	
Campanula rotundifolia	common harebell
Carex aquatilis	water sedge
Carex disperma	soft-leaved sedge
Carex interior	inland sedge
Carex pauciflora	few-flowered sedge
Carex rossii	Ross' sedge
Carex rostrata	beaked sedge
Carex sitchensis	Sitka sedge
Carex spp.	sedges
Carex vaginata	sheathed sedge
Cassiope mertensiana	white mountain-heather
Cassiope spp.	mountain-heathers
Chimaphila umbellata	prince's pine
Cinna latifolia	nodding wood-reed
Circaea alpina	enchanter's nightshade
Cladina mitis	
Cladina spp.	
Cladonia ecmocyna	
Cladonia gracilis	
Cladonia spp.	
Clintonia uniflora	queen's cup
Cornus canadensis	bunchberry
Cornus sericea	red-osier dogwood
Corylus cornuta	hazelnut
Dicranum fuscescens	curly heron's-bill moss
Dicranum pallidisetum	
Dicranum polysetum	wavy-leaved moss
Dicranum scoparium	broom moss
Disporum hookeri	Hooker's fairybells
Drepanocladus spp.	
Drosera rotundifolia	round-leaved sundew
Dryas spp.	mountain-avens
Dryopteris assimilis	spiny wood fern

Elmyus innovatus	fuzzy-spiked wildrye
Empetrum nigrum	crowberry
Equisetum arvense	common horsetail
Equisetum hyemale	scouring-rush
Equisetum pratense	meadow horsetail
Equisetum scirpoides	dwarf scouring-rush
Equisetum spp.	horsetails
Equisetum sylvaticum	wood horsetail
Erigeron peregrinus	subalpine daisy
Eriophorum angustifolium	narrow-leaved cotton-grass
Eriophorum chamissonis	Chamisso's cotton-grass
Eriophorum spp.	cotton-grasses
Fragaria virginiana	wild strawberry
Galium triflorum	sweet-scented bedstraw
Gaultheria hispidula	creeping-snowberry
Geocaulon lividum	bastard toad-flax
Glyceria elata	tall mannagrass
Goodyera oblongifolia	rattlesnake-plantain
Goodyera repens	dwarf rattlesnake orchid
Gymnocarpium dryopteris	oak fern
Hieracium umbellatum	narrow-leaved hawkweed
Hylocomium splendens	step moss
Kalmia microphylla ssp. *occidentalis*	bog-laurel
Lathyrus ochroleucus	creamy peavine
Ledum groenlandicum	Labrador tea
Linnaea borealis	twinflower
Listera cordata	heart-leaved twayblade
Lonicera involucrata	black twinberry
Lonicera utahensis	red twinberry
Luetkea pectinata	partridgefoot
Lycopodium annotinum	stiff club-moss
Lycopodium complanatum	ground-cedar
Lycopodium obscurum	ground-pine
Lysichiton americanum	skunk cabbage

Maianthemum canadense	wild lily-of-the-valley
Matteucia struthiopteris	ostrich fern
Melampyrum lineare	cow-wheat
Menyanthes trifoliata	buckbean
Menziesia ferruginea	false azalea
Mitella nuda	common mitrewort
Mnium insigne	
Mnium medium	
Mnium nudum	
Mnium punctatum var. *elatum*	
Mnium spp.	leafy mosses
Moneses uniflora	single delight
Nephroma arcticum	
Oplopanax horridus	devil's club
Orthilia secunda	one-sided wintergreen
Oryzopsis asperifolia	rough-leaved ricegrass
Oryzopsis pungens	short-awned ricegrass
Paxistima myrsinites	falsebox
Pellia neesiana	
Pellia spp.	
Peltigera aphthosa	
Peltigera canina	dog lichen
Peltigera leucophlebia	
Peltigera malacea	
Peltigera spp.	
Petasites palmatus	palmate colt's-foot
Phyllodoce empetriformis	pink mountain-heather
Phyllodoce spp.	mountain-heathers
Picea engelmannii	Engelmann spruce
Picea glauca	white spruce
Picea glauca x *englemannii*	hybrid white spruce
Picea mariana	black spruce
Pinus albicaulis	whitebark pine
Pinus contorta	lodgepole pine
Pinus monticola	western white pine

Platanthera *obtusata*	one-leaved rein-orchid
Platanthera *orbiculata*	round-leaved rein-orchid
Platanthera *stricta*	slender bog-orchid
Pleurozium *schreberi*	red-stemmed feather moss
Poa spp.	bluegrasses
Polytrichum *juniperinum*	juniper haircap moss
Polytrichum spp.	haircap mosses
Polytrichum *strictum*	
Populus *balsamifera* ssp. *trichocarpa*	black cottonwood
Populus *tremuloides*	trembling aspen
Potentilla spp.	cinquefoils
Pseudotsuga *menziesii*	Douglas-fir
Pteridium *aquilinum*	bracken
Ptilium *crista-castrensis*	knight's plume
Pyrola *asarifolia*	pink wintergreen
Pyrola *chlorantha*	green wintergreen
Rhododendron *albiflorum*	white-flowered rhododendron
Rhytidiadelphus *squarrosus*	bent-leaf moss
Rhytidiadelphus *triquetrus*	electrified cat's-tail moss
Rhytidiopsis *robusta*	pipecleaner moss
Ribes *lacustre*	black gooseberry
Rosa *acicularis*	prickly rose
Rosa spp.	wild roses
Rubus *chamaemorus*	cloudberry
Rubus *idaeus*	red raspberry
Rubus *parviflorus*	thimbleberry
Rubus *pedatus*	five-leaved bramble
Rubus *pubescens*	trailing raspberry
Salix *athabascensis*	Athabasca willow
Salix *myrtillifolia*	bilberry willow
Salix spp.	willows

Sambucus racemosa	red elderberry
Shepherdia canadensis	soopolallie
Smilacina racemosa	false Solomon's-seal
Smilacina trifolia	three-leaved false Solomon's-seal
Solidago spathulata	dryland goldenrod
Sorbus sitchensis	Sitka mountain-ash
Sorbus spp.	mountain-ashes
Sphagnum capillaceum	common red sphagnum
Sphagnum fuscum	common brown sphagnum
Sphagnum girgensohnii	common green sphagnum
Sphagnum magellanicum	
Sphagnum recurvum	
Sphagnum spp.	sphagnums
Sphagnum squarrosum	
Spiraea betulifolia	birch-leaved spirea
Stellaria crispa	crisp starwort
Stereocaulon paschale	
Streptopus amplexifolius	clasping twistedstalk
Streptopus roseus	rosy twistedstalk
Streptopus streptopoides	small twistedstalk
Taxus brevifolia	western yew
Thelypteris phegopteris	beech fern
Thuja plicata	western redcedar
Tiarella trifoliata	three-leaved foamflower
Tiarella unifoliata	one-leaved foamflower
Timmia austriaca	
Tomenthypnum nitens	golden fuzzy fen moss
Tsuga heterophylla	western hemlock
Tsuga mertensiana	mountain hemlock
Vaccinium membranaceum	black huckleberry
Vaccinium myrtilloides	velvet-leaved blueberry

Vaccinium ovalifolium	oval-leaved blueberry
Vaccinium oxycoccus	bog cranberry
Vaccinium vitis-idaea	lingonberry
Vahlodea atropurpurea	mountain hair-grass
Valeriana sitchensis	Sitka valerian
Veratrum viride	Indian hellebore
Viburnum edule	highbush-cranberry
Viola canadensis	Canada violet
Viola orbiculata	round-leaved violet
Viola spp.	violets

10.5 References for Plant Identification

10.5.1 Field Identification

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10.6 Glossary

Brush Hazard: a relative scale (on a Forest Region basis) that indicates the likelihood that desirable tree species will experience competion from other vegetation (undesirable tree species, shrubs, and herbs) on the site before the free-to-grow stage is reached.

Brushing and Weeding: any site treatment that eliminates or reduces competition, from brush (undesirable tree species and shrubs) and weeds (herbs), to recently planted seedlings or natural regeneration.

Cable System: any logging method where some form of high-lead cable system is used to remove logs from a site. The aim of using such a system is to minimize ground disturbance.

Clear-Cutting: a method of logging that involves cutting the entire stand, resulting in total removal of the forest on the area. The term clear-cutting is sometimes erroneously applied to any type of cutting that removes all the merchantable timber but leaves smaller trees, cull trees of merchantable size, and trees of unmerchantable species.

Conventional Logging System: any logging system that is presently in widespread use in the north-central interior. These systems include the use of rubber-tired skidders, hand-falling, snippers, and feller-bunchers.

Commercial Thinning: a mid-rotation harvest of merchantable trees in an immature stand such that a pre-determined number of high quality trees are left behind.

Juvenile Spacing: a reduction in the number of stems per hectare in young stands. The aim of this procedure is to: control stocking; prevent stagnation; increase tree quality; increase growth rates; reduce final harvest and milling costs; and reduce rotation length.

Low Ground Pressure (l.g.p.): harvesting equipment with ground pressure up to 6.3 p.s.i.

Sanitation Spacing: a reduction in the number of stems per hectare by removal of overtopping, pole-sized or large, defective stems (usually remaining after selective logging); or by controlling the density, species composition, and disease level of regeneration through spacing.

Seed-Tree Method: A logging method whereby the area is cut clear except for certain selected seed-trees left standing singly, or in groups, for the purpose of providing seed to restock the area. The volume that is left standing as seed-trees is usually about 10% of the total.

Seed-Tree Control: felling of undesirable and unmerchantable tree species (e.g. western hemlock). This treatment is intended to reduce or eliminate seed dissemination and regeneration of undesirable species.

Shelterwood System: removal of the stand by a series of partial cuttings that are designed to remove the entire stand within a period of time that is a small fraction of the rotation age. As a consequence of this method of harvesting, natural reproduction starts under the protection of the older stand and is released from this protection when able to withstand the exposure. A minimum of two cuttings (2-pass system) is required in the simplest application of the shelterwood system.

Site Preparation: the treatment of soil and ground cover in order to prepare the soil surface as a favourable seed-bed for either naturally or artificially disseminated seed, or planted seedlings.

Spring Break-up: a period in the spring when forest roads are closed because melting snow causes road-beds to be unsuitable for use by heavy equipment.

Tracked Skidding: the use of medium cats (D6 or D7).

Other Recent Titles in the Land Management Report Series

S. Haeussler, J. Pojar, B.M. Geisler, D. Yole, and R.M. Annas. 1984. A Guide to the Coastal Western Hemlock Zone, Northern Drier Maritime Subzone (CWHf), in the Prince Rupert Forest Region, British Columbia. Land Mgmt. Report No. 21. 172 p. plus 2 maps.

This guide briefly outlines the principles and methods of the Ministry of Forests biogeoclimatic classification system, stressing the two primary areas of emphasis within the classification, the biogeoclimatic (zones, subzones, variants), and the ecosystematic (ecosystem associations and their phases and variations). It summarizes the environmental characteristics of the Northern drier maritime subzone of the Coastal Western Hemlock Zone (CWHf) and two of its variants, a lower (CWHf1) and a higher elevation (CWHf2) variant. The classification of the subzone at the ecosystematic level is then presented in detail.

R.W. Campbell, E.D. Forsman, and B.M. Van Der Raay. 1984. An Annotated Bibliography of Literature on the Spotted Owl. Land Mgmt. Report No. 24. 116 p.

The Spotted Owl (Strix occidentalis) was first described by John Xantus, who collected a specimen near Fort Tejon, California in 1859. During the next 15 years the species remained relatively unknown, primarily because of its nocturnal habits and its preference for dense forests in remote, mountainous areas. In the early 1970's, pioneering studies on the Spotted Owl were initiated in Oregon and California. During the decade which followed, this species became the most intensively studied owl on the continent.

Results from research have created a concern for the future of the Spotted Owl in North America. These concerns include:

1. The owl's presumed incompatibility with intensive forest management practices which directly, and indirectly may affect its living space, prey base, and reproductive capacity.
2. The possible threat posed by the invasion of the Barred Owl (Strix varia) into the range of the Spotted Owl.

There is, then, considerable demand for information on the Spotted Owl. This bibliography includes 586 citations and is current through 1983.

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